4.0 ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This chapter discusses the direct, indirect, and cumulative environmental consequences of implementing the alternatives described in Chapter 2, and it is the basis for comparing them. It also includes adverse environmental effects. An impact is described as any change in physical, biological, social, or economic factors, which result from direct or indirect effects of an action. The impacts may be adverse or beneficial depending on the type of change. Effects and impacts, as used in this chapter, are synonymous. The following impact definitions are used:

- Temporary Impact: An impact that occurs during construction and/or for one to two growing seasons thereafter. May also occur after brief activity associated with operations and maintenance.

- Permanent Impact: An impact that continues for an extended period of time or lasts throughout the life of the MDP.

- Direct Impact: An impact that occurs as the direct result of development activity, including construction, operations, and maintenance. Direct impacts are caused by the action occurring at the same time and place.

- Indirect Impact: An impact that develops as the result of a direct impact, and which would not have occurred otherwise. Indirect impacts occur later in time, or further in distance from the action, but are still reasonably foreseeable.

4.2 GEOLOGY AND SOIL RESOURCES

This section describes the potential impacts to soil resources from implementation of any of the action alternatives within the Bridger Bowl Study Area. Temporary impacts to soils include disturbances that will last over a short time period such as creating temporary roads, the clearing of vegetation, grading in areas to be re-vegetated, and utility trenching. Permanent impacts include lift terminal construction, lift tower installation, building construction, and construction of new parking lots. Direct impacts typically have immediate effects in the area of activity and include all of the activities listed above. Indirect impacts include impacts such as increased potential for erosion and mass wasting due to clearing and grading, as well as down slope sediment deposition.

4.2.1 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 1

There are no activities proposed in the Bridger Bowl Study Area under Alternative 1. Currently, 62.0 acres of the Study Area has permanent impacts to soil productivity resulting from past or ongoing activities such as the construction of ski lifts, ski trails, and associated buildings. Because no new activities are proposed under Alternative 1, there would be no new additional direct or indirect impacts to soil productivity. Since there are no new proposed activities in the Bridger Bowl Study Area under Alternative 1, soil erosion conditions would remain unchanged and the same as existing conditions.

4.2.2 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 2

Soils

The proposed activity under Alternative 2 would have approximately 64.3 acres of direct and indirect impacts to soils resources. Permanent impacts would include construction of roads, lift terminals, parking lots and the construction of Limestone Chalet; these would total approximately 7.0 acres. Temporary impacts would occur in both developed and undeveloped areas; temporary impacts in undeveloped areas include construction of lifts, trails, and off-road underground utilities. Most utilities would be buried in road right-of ways and would be categorized as temporary impacts in developed areas (Table 4.2-1). Total temporary impacts to soils would be approximately 57.3 acres. Impacts to soils from clearing without grading would be limited, due to flush cutting techniques, log skidding and removal across snow, and the application of mitigation measures in Table 2.6-1. Existing roads and snow grooming equipment would be used during winter conditions to minimize impacts to ground cover and soils. Impacts to soils from clearing with grading would also be limited, due to similar winter harvest methods and application of mitigation measures in Table 2.6-1.

Table 4.2-1
Impacts to Soil Resources within the Bridger Bowl Study Area

Parameter	Alternative 1 Existing Conditions	Alternative 2 Proposed Impacts	Alternative 3 Proposed Impacts	Alternative 4 Proposed Impacts
Temporary Soil Impacts in Study Area				
Impacts from Clearing (acres)	0.0	+40.5	+37.0	+6.0
Impacts from Grading (acres)	0.0	+16.8	+13.0	+13.5
Total Temporary Soil Impacts (acres)	**0.0**	**+57.3**	**+50.0**	**+19.5**
Permanent Soil Impacts in Study Area				
Impacts from Roads (acres)	40.3	+4.3	+2.8	+2.9
Impacts from Other Impervious Surfaces	21.7	+2.7	+2.5	+2.5
Total Permanent Soil Impacts (acres)	**62.0**	**+7.0**	**+5.3**	**+5.4**
Total Soil Impacts (acres)	**62.0**	**+64.3**	**+55.3**	**+24.9**
% of Study Area w/ Permanent Impacts	**2.4 %**	**+0.3 %**	**+0.2 %**	**+0.2 %**

Grading impacts to roads are based are based on a 30 foot wide road, but permanent impacts are based on 20 foot wide roads. In areas where vegetation clearing and grading occur impacts are categorized as only grading.
Source: SE Group

Erosion Hazard

Alternative 2 would have impacts to soils with varying levels of erosion hazards from the construction of roads, parking lots, lift terminals, and construction of Limestone Chalet. These activities would have approximately 2.8 acres of temporary impacts and approximately 1.7 acres of permanent impacts on high erosion hazard soils (see Table 4.2-2). Moderate erosion hazard soils are wide spread and would have approximately 9.2 acres of temporary impacts and 4.1 acres of permanent impacts. Approximately 4.7 acres of temporary impacts and approximately 1.2 acres of permanent impacts occur on low erosion hazard soils under Alternative 2. The majority of impacts would occur on the low to moderate erosion hazard soils. Mitigation measures would be implemented to prevent large-scale erosion. Impacts to soils would be limited through revegetation of disturbed areas according to the Implementation and Monitoring Plan in Appendix D and the application of mitigation measures.

Figure 4-1: Proposed Impacts to Soil Erosion Potential Under Alternative 2

Table 4.2-2
Impacts to Soils from Grading
by Erosion Hazard within the Bridger Bowl Study Area

Erosion Hazard	Alternative 1 Existing Conditions	Alternative 2 Proposed Impacts	Alternative 3 Proposed Impacts	Alternative 4 Proposed Impacts
High (acres)				
Temporary	0.0	2.8	2.2	2.1
Permanent	0.0	1.7	1.6	0.8
Moderate (acres)				
Temporary	0.0	9.2	7.7	7.3
Permanent	0.0	4.1	3.3	3.5
Low (acres)				
Temporary	0.0	4.7	3.1	4.1
Permanent	0.0	1.2	0.4	1.2
Totals (acres)				
Temporary	**0.0**	**16.7**	**13.0**	**13.5**
Permanent	**0.0**	**7.0**	**5.3**	**5.5**

Source: SE Group

Sediment Yield

The sediment model includes the four watersheds that are present in the ski area and predicts sediment yield at the mouth of each these watersheds at the scale of the 6,160-acre Watershed Model Analysis Area. Sediment modeling was conducted under the assumption that all new ski area facilities, roads, and trails would be constructed in 2005. This provides a worst-case scenario and a conservative estimate for disclosure purposes since implementation of all project elements proposed under Alternative 2 would likely be constructed over several years; sediment levels would not be as concentrated as this analysis indicates. These estimates, although an attempt to predict actual annual sediment discharge, should be used as a relative comparison between alternatives, and as an indication of sediment recovery rates over time. In order to run the model for the South Fork of Brackett Creek, Maynard Creek, and Slushman Creek, all existing watershed disturbances by date were factored for all of land ownership (roads, timber harvest units, ski trails, ski area facilities, parking lots, residential developments).

SF of Brackett Creek sediment yield is currently estimated at 8.2 percent over natural conditions with existing impacts from roads. Development of Alternative 2 would increase sediment yield in model year 2005 by approximately 1.6 tons per year over existing conditions, which would be 10.1 percent over natural conditions. Sediment yield is projected to recover to near existing condition levels by 2011, which is predicted to be 8.4 percent above natural conditions.

Maynard Creek is currently the most impacted watershed within the Study Area with existing sediment yields estimated at 63.7 tons/year, or 76.9 percent above the natural

sediment yield of 36 tons/year. Proposed development under Alternative 2 is projected to increase sediment by an estimated 2.5 tons/year to 83.9 percent above natural levels in 2005. The sediment modeling predicts Maynard Creek sediment would decrease to 78.6 percent above natural rates by 2011.

Slushman Creek sediment yields are currently estimated at 26.6 percent over natural conditions with 100.0 tons/year of sediment yield. Under Alternative 2 sediment increase in the Slushman drainage would occur from construction of the S1 and P2 lifts, ski runs, and the winter/summer road to provide access back to the bottom of Pierre's Knob lift by an estimated 1.5 tons/year to 28.4 percent over natural conditions. It is anticipated to decline to 27.0 percent over natural conditions by 2011.

Table 4.2-3
Sediment Yield Potential to Watersheds within the Watershed Model Analysis Area

Watershed	Alternative 1 Existing Conditions (tons/year)	Alternative 2 Proposed Impacts (tons/year)	Alternative 3 Proposed Impacts (tons/year)	Alternative 4 Proposed Impacts (tons/year)
SF Brackett	89.8	+1.6	+1.6	+0.0
Upper Bridger Creek	161.2	+3.5	+3.5	+2.4
Maynard	63.7	+2.5	+2.5	+1.3
Slushman	100.0	+1.5	+0.0	+1.5
Total	**414.7**	**+9.1**	**+7.6**	**+5.2**

Source: USFS, Mark Story, 2004.

Soil Productivity

Soil productivity would also be altered by the proposed activities in Alternative 2. The removal and/or disturbance of the soil profile by roads, parking lots, terminals, and Limestone Chalet construction would be considered a permanent impact. Permanently impacted soil would have a greatly reduced capacity for soil productivity due to the impervious nature of these activities. Approximately 7.0 acres of soil productivity would be permanently impacted by construction of proposed buildings, roads, and parking lots under Alternative 2 (see Table 4.2-1). The soil impacts proposed under Alternative 2 would increase the permanent impacts to soil productivity within the Study Area by 0.3 percent; bringing the total for existing and proposed impacts to 2.7 percent of the Study Area. Temporary impacts to soil productivity from clearing and grading would be limited via flush cutting techniques, skidding and removal of vegetation over snow, and the application of mitigation measures in Table 2.6-1.

4.2.3 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 3

Soils

Under Alternative 3, impacts to soils resources would be fewer than those disclosed under Alternative 2, due to the reduction of activities in the Slushman watershed. The SF

Brackett Creek, Upper Bridger Creek, and Maynard Creek watersheds would have approximately 5.3 acres of permanent impacts under the proposed activities in Alternative 3. Temporary impacts to soils would be approximately 50.0 acres. The total area of soils impacted would be approximately 55.3 acres (Table 4.2-1). Similar impact avoidance and minimization activities discussed in the Alternative 2 would be practiced to minimize impacts to soil.

Erosion Hazard

Soil erosion hazard areas could be altered by the proposed activities of Alternative 3, but the impacts would be less than in Alternative 2. The majority of impacts would occur on low to moderate erosion hazard soils. Activities in Alternative 3 would have approximately 2.2 acres of temporary impacts and approximately 1.6 acres of permanent impacts on high erosion hazard soils (Table 4.2-2). Moderate erosion hazard soils are wide spread and would have approximately 7.7 acres of temporary impacts and 3.3 acres of permanent impacts. Approximately 3.1 acres of temporary impacts and approximately 0.4 acre of permanent impacts would occur on low erosion hazard soils as a result of proposed activities in Alternative 3. Similar impact prevention activities previously discussed in the Alternative 2 would be practiced to minimize impacts to soil.

Sediment Yield

Sediment yield impacts of Alternative 3 would be similar to Alternative 2 except that the proposed facilities and trails in the Slushman Creek watershed would not be developed. Sediment yield in Slushman Creek would not be affected by activities proposed under Alternative 3, so the sediment yield would remain at 26.6 percent over baseline as the existing timber sale areas on public and private land outside of the Study Area recover from past timber harvest activities. Alternative 3 sediment impacts to Maynard Creek, Upper Bridger Creek, and SF Brackett Creek would be the same as the impacts disclosed under Alternative 2.

Soil productivity

Soil productivity would be altered by the proposed activities of Alternative 3, but the impacts would be fewer than those disclosed under Alternative 2. Permanently impacted soils would have a highly reduced capacity for soil productivity due to the impervious nature of these activities. Approximately 5.3 acres of soil productivity would be permanently impacted by construction of proposed buildings, roads, and parking lots activities under Alternative 3. The soil impacts proposed under Alternative 3 would increase the permanent impacts to soil productivity within the Study Area by 0.2 percent; bringing the total for existing and proposed impacts to 2.6 percent of the Study Area. Similar impact avoidance and minimization activities previously discussed in the Alternative 2 would be practiced to reduce impacts to soil productivity (see Table 2.6-1).

4.2.4 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 4

Soils

The proposed activities of Alternative 4 would have impacts to soils, but the impacts would be less than those disclosed for alternatives 2 and 3. Permanent impacts would be reduced due to the reduction in activities in the Bradley Meadows area. Permanent impacts to soils would be reduced to approximately 5.4 acres. Temporary impacts would still occur in areas proposed for clearing and grading and would be approximately 19.5 acres. The total area of soils impacted would be approximately 24.9 acres (Table 4.2-1). Similar impact prevention activities previously discussed in the Alternative 2 would be practiced to minimize impacts to soil.

Erosion Hazard

Soil erosion hazard areas would be altered by the proposed activities in Alternative 4, but the impacts would be less than in alternatives 2 and 3. Impacts would be reduced due to a reduction of activities in the Brackett watershed. Activities in Alternative 4 would have approximately 2.1 acres of temporary impacts and approximately 0.8 acre of permanent impacts on high erosion hazard soils (Table 4.2-2). Moderate erosion hazard soils are wide spread and would have approximately 7.3 acres of temporary impacts and 3.5 acres of permanent impacts. Approximately 4.1 acres of temporary impacts and approximately 1.2 acres of permanent impacts would occur on low erosion hazard soils as a result of Alternative 4 activities. Similar impact prevention activities previously discussed in the Alternative 2 would be practiced to minimize impacts to soil.

Sediment Yield

Sediment yield impacts of Alternative 4 would be less then alternatives 2 and 3 due to the reduced development in the SF Brackett Creek, Upper Bridger Creek, and Maynard Creek watersheds. Sediment impacts to Slushman Creek under Alternative 4 would be the same as those disclosed under Alternative 2. The increase in sediment yield to Maynard Creek and Upper Bridger Creek would be less than alternatives 2 and 3 since the road access to and trail access from chairlifts N-1 and P-3 would not be constructed. Sediment impacts in the SF Brackett Creek would be the same as Alternative 1 because the expansion of trails and chairlifts in the Bradley Meadows area would not be developed. Sediment yields in SF Brackett Creek would remain at about 8.2 percent over natural conditions.

Soil productivity

Soil productivity would be altered by the proposed activities in Alternative 4, but the impacts would be less than those disclosed for alternatives 2 and 3. A reduced level of activity in the Bradley Meadows area would reduce the total amount of impacts to soil productivity. Proposed activities in Alternative 4 would permanently impact soil productivity in approximately 5.4 acres of land. The soil impacts proposed under Alternative 4 would increase the permanent impacts to soil productivity within the Study Area by 0.2 percent; bringing the total for existing and proposed impacts to 2.6 percent of

the Study Area. Similar impact prevention activities previously discussed in the Alternative 2 would be practiced to minimize impacts to soil.

4.2.6 FOREST PLAN CONSISTENCY

A Forest-wide standard that applies to soil and site productivity is as follows: all practices will be designed or modified as necessary to maintain land productivity (USDA, 1987, pg.II-24). The potential increase in permanent soil productivity impacts of 7.0 acres would constitute a slight decrease in land productivity at the Scale of the GNF. Since this Forest Plan standard applies to land management at the GNF scale, the potential impacts from the Proposed Action would be consistent with Forest Plan Standard 10.8 (USDA, 1987, pg. II-24)

The tree clearing proposed in the Proposed Action would follow mitigation measures in Table 2.6-1 and the Implementation and Monitoring Plan in Appendix D. Provided that these mitigation measures and BMPs are followed, the Proposed Action would be consistent with Forest Plan Standard 8.b.1.c, which states, "Site preparation and debris disposal methods will be prescribed which maintain an adequate nutrient pool for long-term site productivity through the retention of topsoil and soil organisms" (USDA, 1987, pg. II-21).

A final Forest Plan Standard that is specific to Management Area 2 requires that erosion control measures be applied to control surface erosion and mass failure hazards on disturbed areas. Proper implementation of the Proposed Action, including mitigation measures and the Implementation and Monitoring Plan, would ensure consistency with this Forest Plan Standard.

4.3 WATER RESOURCES

This section describes the potential effects of each of the proposed alternatives on water resources within the Study Area. A description of the existing conditions of the water resources at Bridger Bowl is presented in Section 3.3 – Water Resources. The analysis of existing conditions in Chapter 3 is the basis by which the proposed development activities within each of the alternatives have been evaluated. It is important to note that the scope of this analysis on the effects of the proposed alternatives is dependent on the nature of the historic and ongoing impacts and the availability of data for the Study Area. All of the alternatives attempt to maintain or improve the existing condition of watershed resources within the Study Area through the implementation of the proposed mitigation measures. GIS analyses using stream, wetland, topographic, and land cover data provided quantitative evaluation of the various alternatives. The primary issues addressed under each alternative include the maintenance or restoration of stream characteristics, wetlands, water quantity, and water quality.

The physical actions associated with components of the alternatives that result in impacts to water resources are referred to as impact mechanisms in this analysis. Impacts can occur during construction, or after construction through ski area operations and maintenance, and they can directly or indirectly affect resource functions. Direct impacts have immediate effects in the area that they occur, while indirect impacts have delayed effects at or some distance from their origin. Indirect impacts up to five years in duration are considered as temporary because monitoring would enable detection and stabilization of most effects well within the implementation period.

4.3.1 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 1

Streams

Under Alternative 1, no new developments are proposed at Bridger Bowl; therefore, there would be no new impacts to streams within the Study Area. The road network at Bridger Bowl would remain the same; no new stream crossings would occur, and the road density would remain the same. The results of the R1R4 analysis (see Table 4.2-3) show that under Alternative 1, a total sediment load of 414.7 tons per year are delivered to Slushman Creek, Maynard Creek, Upper Bridger Creek, and South Fork of Brackett Creek (SF Brackett) under existing conditions. Currently, these four streams meet GNF sediment standards for Class A and Class D streams.

Wetlands

Under Alternative 1, there would be no impacts to wetlands in the Study Area; there would remain 41 wetlands for an approximate total of 45.0 acres. Wetlands would continue to provide the same ecological functions as they do under existing conditions.

Water Quantity

Under Alternative 1, there would be no new impacts to the surface water or the ground water at Bridger Bowl. Annual water yield for each of the watersheds would remain as

described in Chapter 3. The groundwater wells would also remain in existing conditions as described in Section 3.3. Water consumption by visitors would remain at approximately three gallons per person per day, and snowmaking would continue to occur on 27 acres.

Water Quality

Under Alternative 1, sediment yield impacts to watersheds originating in the Study Area would remain at existing levels of 414.7 tons per year (see Table 3.3-4). Under Alternative 1, sediment levels in Slushman Creek would continue to drop as previously disturbed areas continue to recover. Any increased impacts on water yield under the Alternative 1 are expected to be immeasurable. The wastewater treatment systems at Bridger Bowl would continue to operate at their current capacity.

In the foreseeable future, the East Gallatin River, to which the Bridger Creek is a tributary, may be placed back onto the 303(d) list for exceeding TMDLs because it would likely be re-assessed in 2005 (Story, 2003). The Shields River, to which SF Brackett Creek is a tributary, would likely remain on the 303(d) list unless it is rehabilitated and water quality improves (MDEQ, www.deq.state.mt.us/wqinfo/303_d/303d_information.asp, March 24, 2004).

Bridger Bowl would continue to make maintenance improvements to access roads, parking, and ski trails. This activity would be guided by application of BMPs in Appendix D, and any impacts to water quality would be short-term and/or negligible as long as the BMPs were installed correctly.

4.3.2 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 2

Streams

Any graded areas of land are temporary potential sources of sediment yield impacts to streams until they are stabilized. Watershed developments such as roads, clearcuts, ski trails, buildings, and parking lots can directly impact streams by allowing sediment yield to be eroded directly into streams. As shown in Table 4.3-1, the total length of roads within the study area would increase by 1.8 miles, causing the road density increase from 4.0 mi/mi^2 to 4.4 mi/mi^2. Another potential source of sediment to streams at Bridger Bowl is locations where streams cross roads, usually either in culverts or under bridges. Under Alternative 2, there would be one new road stream crossing of Slushman Creek, which may be a potential source of sediment to streams within the Study Area.

In Alternative 2, there is a proposed stream road crossing that is located in the Slushman Drainage. Because this culvert installation would require grading work within Slushman Creek, a 310 Permit would be required from the MDEQ. Mitigation measure RP-1 in Table 2.6-1 would minimize potential channel impacts and indirect sediment impacts. In addition, a list of required BMPs and agency guidelines are included in the Implementation and Monitoring Plan in Appendix D of this document.

Figure 4-2: Potential Impacts to Watershed Resources Under Alternative 2

Table 4.3-1
Road Characteristics in the Bridger Bowl Study Area

Parameter	Alternative 1 Existing Conditions	Alternative 2 Proposed Impacts	Alternative 3 Proposed Impacts	Alternative 4 Proposed Impacts
Number of Road Stream Crossings				
Perennial	5	+1	0	+1
Intermittent	24	0	0	0
Total Road Stream Crossings	**29**	**+1**	**0**	**+1**
Length of Roads in Study Area				
Roads on NFS Lands (miles)	8.6	+1.4	+0.8	+0.9
Roads on Private Lands (miles)	7.3	+0.4	+0.2	+0.3
Total Roads in the Study Area (mi.)	**15.9**	**+1.8**	**+1.0**	**+1.1**
Road Density in Study Area (mile/mile^2)	4.0	+0.4	+0.3	+0.3

Induced sedimentation from the proposed developments and disturbances in the watersheds draining the Study Area was evaluated using the R1R4 model (Cline et al., 1981). In order to run the R1R4 model for SF Brackett Creek, Upper Bridger Creek, Maynard Creek, and Slushman Creek, all existing watershed disturbances were factored by date for all of the different land cover types (roads, timber harvest units, ski trails, ski area facilities, parking lots, etc.). The results of the analyses are presented in the Geology and Soil Resources section and summarized in Table 4.2-3. The sediment model results indicate that under Alternative 2, a total of 9.1 tons per year more sediment would be delivered to the aforementioned streams, which is a 2.2 percent increase over existing conditions.

Wetlands

Executive Order 11990, Protection of Wetlands, calls for the identification, assessment, and protection of wetlands by requiring Federal agencies to avoid, if possible and practicable, adverse impacts to wetlands and to preserve and enhance the natural and beneficial values of wetlands. As shown in Table 4.3-2, there would be no grading impacts to wetlands under Alternative 2 and there would be a total of 0.48 acres of clearing in wetlands within the Study Area. For any vegetation removal that is done in wetlands, the clearing prescription in Chapter 2 states that trees would be cut flush to the ground, the stumps would not be removed, and trees would be moved by dragging them out over the snow. In addition mitigation measures VM-3, VM-4, and VM-6 have been developed to avoid and/or minimize direct and incidental indirect impacts to wetlands (see Table 2.6-1). Due to the location of wetlands within the Study Area, the clearing prescriptions, and proposed mitigation measures, there would be no significant adverse impacts to wetlands under Alternative 2.

Table 4.3-2
Potential Clearing Impacts to Wetlands in the Study Area

Impact Type	Alternative 1 Proposed Impacts	Alternative 2 Proposed Impacts	Alternative 3 Proposed Impacts	Alternative 4 Proposed Impacts
Wetland Impacts from Grading (acres)	0.0	0.0	0.0	0.0
Wetland Impacts from Clearing (acres)	0.0	0.48	0.48	0.0
Total Wetland Impacts (acres)	**0.0**	**0.48**	**0.48**	**0.0**

Water Quantity

Developments such as roads, clearcuts, ski trails, buildings, and parking lots can also indirectly impact water resources; reducing transpiration and infiltration by eliminating vegetation and compacting soil all could potentially increase the water yield to creeks within the Study Area. In addition, roads and drainage ditches can increase the efficiency of conducting overland flow to stream systems and increase water yield. Under Alternative 2, the water yield in SF Brackett Creek, Upper Bridger Creek, Maynard Creek, and Slushman Creek is expected to increase slightly with implementation of project elements. In Alternative 2, the projected increases in water yields for the watersheds range from 0.2 percent to 1.0 percent above natural conditions, which is 0.1 percent to 0.8 percent above existing conditions. The projected increase in water yield above existing conditions is considered too small to be measurable. Therefore, Alternative 2 would not change the water yield enough to create any additional channel scour or other impacts to streams.

Water Quality

Sediment guidelines have been developed by the GNF based on fisheries being the primary beneficial use of forest streams. SF Brackett Creek is classified as a Class A stream in the GNF due to the presence of Yellowstone cutthroat trout in the lower reaches of its drainage. According to GNF guidelines, to protect Class A streams, sediment increases should not exceed 30 percent above natural rates. Streams with sediment yields that are within 30 percent of natural rates are considered consistent with the 1999 Memorandum of Understanding (MOU) with the Bureau of Land Management for protecting Yellowstone and westslope cutthroat trout populations through maintaining at least 90 percent of optimum habitat conditions. Section 4.6 – Fisheries contains a more detailed description of the 1999 MOU and the management implications. Assuming all SF Brackett Creek development was done in 2005, the R1R4 model predicted that sediment would increase by 1.6 tons per year to 91.4 tons per year, which would represent an increase from 8.2 percent over natural to 10.1 percent over natural rates. The sediment increase in SF Brackett Creek would decrease to 8.4 percent over natural by 2011. The modeled sediment delivery rate for Alternative 2 for SF Brackett Creek is well below the 30 percent standard set by the GNF to meet conditions of the 1999 MOU.

Maynard, Upper Bridger, and Slushman Creeks are considered Class D streams in the GNF since there is no documented presence of fish in these drainages. The main

emphasis in Class D streams is to maintain geomorphic integrity without excessive downstream sediment discharge. According to GNF guidelines, to protect Class D streams, sediment increases should not exceed 100 percent above natural rates. The maximum sediment delivery to Upper Bridger Creek due to construction activities in proposed under Alternative 2 is estimated to increase delivery rates by 3.5 tons per year in 2005, which is an increase from 33.2 percent over natural conditions to 36.1 percent over natural conditions. Maynard Creek sediment would increase by 2.5 tons per year in 2005 to 66.2 tons per year, which is an increase from 76.9 percent over natural conditions to 83.9 percent over natural. The sediment increase in Maynard Creek would decrease to 78.6 percent over natural rates by 2011. Sediment levels in Slushman Creek would increase by 1.5 tons per year to 101.5 tons per year, which is an increase from 26.6 percent over natural rates to 28.4 percent over natural rates. The sediment increase in Slushman Creek would decrease to 27 percent over natural rates by 2011. Increases in sediment yield to these three streams as a result of activities proposed under Alternative 2 would not exceed the 100 percent above natural rates GNF guidelines for Class D streams.

Mitigation measures and BMPs would be used during all of the proposed ski area construction activities to minimize erosion and sedimentation, and to protect water quality. Bridger Bowl would continue to make maintenance improvements to access roads, parking and ski trails, which would be guided by application of BMPs outlined in Appendix D; therefore, any impacts to water quality would be short-term and/or negligible.

As stated previously, the East Gallatin River, to which the Bridger Creek is a tributary, may be placed back onto the 303(d) list for exceeding TMDLs because it would likely be re-assessed in 2005 (Story, 2003). The Shields River, to which the SF Brackett Creek is a tributary, would likely remain on the 303(d) list unless it is rehabilitated and water quality improves. The potential sediment yield impacts from Alternative 2 are expected to be too small to have any measurable impacts on the water quality conditions of either the Shields River or the East Gallatin River. Therefore, Alternative 2 would likely not contribute to the 303(d) listing of these two waterbodies.

Potential water quality impacts from oil and grease pollution from parking lot runoff would be minimized by implementing the mitigation measures listed in Chapter 2 of this document.

4.3.3 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 3

Streams

Under Alternative 3, the total length of roads within the Study Area would increase by 1.0 miles, causing the road density increase from 4.0 mi/mi^2 to 4.3 mi/mi^2 within the Study Area There are no new road stream crossings proposed in Alternative 3.

Wetlands

Impacts to wetlands under Alternative 3 would be the same as Alternative 2 with a total of 0.48 acres of clearing in wetlands within the Study Area. Mitigation measures VM-3, VM-4, and VM-6 have been developed to avoid and/or minimize direct and incidental indirect impacts to wetlands (see Table 2.6-1). Due to the location of wetlands within the Study Area, the clearing prescriptions, and proposed mitigation measures, there would be no significant adverse impacts to wetlands under Alternative 3.

Water Quantity

In Alternative 3, the projected increases in water yields ranges from 0.2 percent to 1.0 percent above natural conditions, which is 0 to 0.8 percent above existing conditions. The projected increases in water yield would only occur in Maynard Creek, SF Brackett Creek, and Upper Bridger Creek, and is considered too small to be measurable. Therefore, Alternative 3 would not change the water yield enough to create any additional channel scour or other impacts to streams.

Water Quality

Under Alternative 3, the estimated maximum sediment yield in SF Brackett Creek would be 1.6 tons per year. The projected increase in sediment yield would be the same as under Alternative 2, and therefore, Alternative 3 also meets GNF sediment standards for Class A streams. The estimated maximum sediment increase for Upper Bridger Creek and Maynard Creek under Alternative 3 would also be the same as under Alternative 2. Therefore, potential sediment increases to these two streams would meet the GNF sediment standard for Class D streams. No development would occur in the Slushman Creek watershed under Alternative 3 so there would be no new sediment related water quality impacts to Slushman Creek and it would continue to meet GNF standards for Class D streams. The implementation of mitigation measures and BMPs outlined in Appendix D would help reduce potential impacts from development in these areas to streams in the Study Area. The potential sediment yield impacts from Alternative 3 are expected to be too small to have any measurable impacts on the water quality conditions of either the Shields River or the East Gallatin River. Therefore, Alternative 3 would likely not contribute to the 303(d) listing of these two waterbodies.

4.3.4 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 4

Streams

The total length of roads within the Study Area would increase by 1.1 miles, causing the road density increase from 4.0 mi/mi^2 to 4.3 mi/mi^2 within the Study Area. There is one new road stream crossing proposed in Alternative 4, which could be a new source of sediment to streams within the Study Area. Mitigation measure RP-1 in Table 2.6-1 would minimize potential channel impacts and indirect sediment impacts. In addition, a list of required BMPs and agency guidelines are included in the Implementation and Monitoring Plan in Appendix D of this document. Because this culvert installation would

require grading work within Slushman Creek, a 310 Permit would be required from the MDEQ.

Wetlands

Under Alternative 4, there would be no clearing in wetlands within the Study Area because there is no development proposed in the SF Brackett Creek watershed. Due to the location of the Proposed Action to wetlands within the Study Area, there would not be impacts to wetlands under Alternative 4.

Water Quantity

In Alternative 4, the projected increases in water yields over existing conditions is estimated at 0.1 percent for Maynard and Upper Bridger Creeks and 0.2 percent for Slushman Creek which is considered too small to be measurable. Therefore, Alternative 4 would not change the water yield enough to create any additional channel scour or other impacts to streams.

Water Quality

Under Alternative 4, the estimated maximum sediment yield in Slushman Creek would be 1.5 tons per year, which is the same as under Alternative 2 (see Table 4.2-3 in Soil Resources). Increased sediment delivery predicted in the model for Alternative 4 would meet the GNF sediment standard for Class D streams as described for Alternative 2. The estimated maximum sediment increase in Maynard Creek would be 1.3 tons per year, which is 1.2 ton per year less then proposed sediment impacts under Alternative 2. Potential sediment delivery to Upper Bridger Creek under Alternative 4 would be 2.4 tons per year, which is less then the 3.5 tons per year that is estimated for Alternative 2. The estimated increases in sediment delivery to these two streams from Alternative 4 would meet GNF sediment standards for Class D streams because the delivery rates would by less those estimated for Alternative 2 which meets the standard. Alternative 4 would not result in any new sediment delivery impacts because development would not occur in the Bradley Meadows area. The implementation of BMPs and applicable mitigation measures would help reduce potential impacts from development in these areas to streams in the Study Area. The potential sediment yield impacts from Alternative 4 are expected to be too small to have any measurable impacts on the water quality conditions of either the Shields River or the East Gallatin River. Therefore, Alternative 4 would likely not contribute to the 303(d) listing of these two waterbodies.

4.3.6 FOREST PLAN CONSISTENCY

Watersheds would be managed by the application of the mitigation measures listed in Chapter 2 and erosion control BMPs identified in the Implementation and Monitoring Plan in Appendix D. Implementation of these practices will ensure that the Proposed Action is consistent with Forest Plan standard 10.2 (USDA, 1987, pg. II-23).

A watershed cumulative effects analysis has been completed to determine if water and sediment yields increase beyond the acceptable limits of the GNF. The analysis

contained in the Cumulative Effects Section (Section 4.16) indicates that the Proposed Action is consistent with Forest Plan Standard 10.3 (USDA, 1987, pg. II-23).

The analysis of potential wetland impacts indicates that no grading or fill activities would take place in wetlands and potential direct and indirect impacts would be minimize through implementation of mitigation measures VM-3, VM-4, and VM-6. Therefore, the Proposed Action is consistent with Executive Order 11990 (Protection of Wetlands) and Forest Service Policy in FSM 2527 as required by Forest Plan Standard 10.5 (USDA, 1987, p. II-23).

The Forest Service would work closely with Bridger Bowl and other private landowners to develop mutually agreeable watershed management direction in order to be consistent with Forest Plan Standard 10.9 (USDA, 1987, pg. II-24).

Wetland mitigation measures comply with Executive Order 11990 (Protection of Wetlands) and Forest Service Policy in FSM 2527 (p. II-23).

4.4 VEGETATION

4.4.1 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 1

Plant Communities

No new ski lifts, trails, parking areas, or base area facilities would be developed under Alternative 1; therefore, the existing vegetation communities would not be disturbed. Plant community types would remain as described in existing conditions in Chapter 3. Natural processes and human intervention would continue to modify stand features and character.

Threatened, Endangered, and Sensitive Plant Species

There were no threatened or sensitive plant species identified within the project area under the 1997 survey. With no action proposed, this Alternative would have no impacts to federally listed or sensitive plant species. Habitat for these species does exist, but would not be impacted under Alternative 1.

Fragmentation and Old Growth

Alternative 1 would have no direct or indirect effects on old growth habitat because no old growth would be altered. This alternative would also have no effects on forest fragmentation because no actions are proposed that would reduce interior forest or create more forested edge. The forest conditions under Alternative 1 would be as described in existing conditions in Chapter 3. Over time, some increases in the dead and down woody component would occur. The additional down debris is expected to add to understory complexity and low level vertical structure (Novak, 2003). Additionally, it is likely that the amount of old growth forest would increase in the Fragmentation Analysis Area (FAA) over the long term because large portions of mature forests within these compartments would be allowed to grow into old growth forest.

4.4.2 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 2

Plant Communities

Implementation of Alternative 2 would modify existing plant communities in the Study Area through clearing of 59.0 total acres of existing plant communities (see Table 4.4-1). Approximately 45.8 acres of forested plant communities and 13.2 acres of non-forested plant communities would be cleared for ski trails, roads, buildings, and chairlifts. Out of the 59.0 acres of clearing, approximately 7.0 acres of vegetation would be permanently removed for the construction of roads, buildings, and lift terminals. Mature and old growth spruce and subalpine fir forest receives most of the proposed impacts with 29.4 of the 45.8 acres of proposed clearing.

Figure 4-3: Alt 2 Vegetation Community Impacts

Table 4.4-1
Plant Community Impacts within the Bridger Bowl Study Area

Plant Communities	Alternative 1 Existing (acres)	Alternative 2 [a] Impacts (acres)	Alternative 3 [a] Impacts (acres)	Alternative 4 [a] Impacts (acres)
Old growth				
Douglas Fir	22.0	-0.4	-0.4	-0.0
Lodgepole pine	50.3	-4.1	-4.1	-0.0
Spruce/Sub Alpine Fir	110.6	-12.6	-12.6	-0.1
Total Old growth	**182.9**	**-17.1**	**-17.1**	**-0.1**
Mature				
Douglas Fir	290.4	-5.4	-5.4	-4.0
Lodgepole pine	27.7	-0.0	-0.0	-0.0
Spruce/sub alpine Fir	116.7	-16.8	-16.8	-0.3
Mixed conifer	168.2	-3.9	-0.9	-3.3
Total Mature	**603.0**	**-26.1**	**-23.1**	**-7.6**
Immature				
Douglas Fir	23.3	-0.3	-0.0	-0.3
Lodgepole pine	77.7	-0.0	-0.0	-0.0
Spruce/sub alpine Fir	39.1	-1.2	-0.5	-0.7
Mixed conifer	29.2	-1.1	-0.0	-1.1
Quaking Aspen	15.3	-0.0	-0.0	-0.0
Total Immature	**184.6**	**-2.6**	**-0.5**	**-2.1**
Total Forest Cover	**970.5**	**-45.8**	**-40.7**	**-9.8**
Non-forest Cover				
Shrub	20.8	-0.0	-0.0	-0.0
Herbaceous	1,072.5	-11.0	-9.1	-8.1
Rock and Talus	449.4	-2.2	-1.8	-1.4
Total Non-forest	**1,542.7**	**-13.2**	**-10.9**	**-9.5**
Grand Total	**2,513.2** [b]	**-59.0**	**-51.6**	**-19.3**

[a] The numbers displayed for alternatives 2, 3, and 4 represent impacts to the existing plant community areas listed in Alternative 1.
[b] Total Vegetation Cover does not equal the Study Area size of 2,574 because there are approximately 63.6 acres on open water and developed land that is not vegetated..

Threatened, Endangered, and Sensitive Plant Species

Implementation of Alternative 2 would have no effect on federally listed plant species. Ute Ladies' Tresses (*Spiranthes diluvialis*) occur in meandered wetlands and swales in broad, open valleys, at margins with calcareous carbonate accumulation (MNHP, 2003). Although many wetlands occur within the Bridgers, this habitat type is not common within the steep and narrow valleys of the Study Area. Similarly, the elevation range of Ute Ladies' Tresses, 4050-5080 feet, is well below the Study Area low point of 5900 feet. Ultimately, the sensitive plant survey field maps and plant check list made no reference to the occurrence of Ute Ladies' Tresses. Oregon Checker-mallow (*Sidalsea oregana*), a federally proposed species for listing, occurs in valley grasslands at elevations ranging from 3026-6840. Habitat may occur within the study area but a determination is not required until listed.

Implementation of Alternative 2 would have no effect on the sensitive plant species surveyed for under the 1997 sensitive plant survey, as no sensitive plant species were identified. Under mitigation measure VM-5 (see Table 2.6-1), the two sensitive plant species which were not surveyed for during the 1997 survey, Shoshonea and Small-flowered pennycress, and the three 1999 newly listed plants, would be surveyed for prior to any disturbance relating to proposed activities. Habitat for these sensitive plant species does occur within the Study Area and may be impacted by the proposed alternative.

Habitat for the three sensitive plant species listed in 1999, English sundew (*Drosera anglica*), Slender cottongrass (*Eriophorum gracile*), and Beaked spikerush (*Eleocharis rostellata*) does occur within the Bridger Bowl Study Area. Surveys for these sensitive plant species have not been conducted. The "Sensitive Plant Survey Form" used in the McCarthy 97 sensitive plant survey does not list the occurrence of these species. Impacts to theses sensitive plant species can not be determined at this time because a survey was not done specifically for these species in 1997 and would be addressed under mitigation measure VM-5 (see Table 2.6-1).

Fragmentation and Old Growth

The proposed activities under Alternative 2 in the Bradley Meadows area would fragment a portion of the second largest interior forest patch in the FAA. It is important to note that the largest interior forest patch in the FAA is actually located in the Bangtail Mountains. So the interior forest patch in the Bradley Meadows area is the largest patch in the Bridger Range, but the second largest in the FAA. This interior forest patch would change from an existing area of 832 acres to two smaller patches of 413 acres and 182 acres. The other nine interior forest patches within the FAA would not be affected by Alternative 2 (Novak, 2003). The current amount of forested habitat identified within the FAA as interior forest is 35 percent. Interior forest was defined as any patch greater than 80 acres of mature and old growth forest. If the chairlifts and runs proposed in the Bradley Meadows area under Alternative 2 are constructed, interior forest within the FAA would decrease by approximately 2 percent from existing conditions. The reduction of interior forest due to Alternative 2 would be occurring in an area (FAA) where fragmentation is high in relation to other compartments analyzed on the Gallatin National Forest (GNF) (Novak, 2003). Actions proposed in the Slushman Creek Drainage under Alternative 2 would have no effect to the fragmentation of interior forest in the FAA.

Activities proposed under Alternative 2 would clear approximately 17.1 acres of old growth within the Bridger Bowl Study Area. Approximately 75 percent of the old growth impacted would be in the spruce/sub alpine fir plant community type. As directed by the GNF Forest Plan, potential impacts to old growth were also analyzed at the Timber Compartment scale to determine consistency with the Forest Plan. According to GIS analysis, approximately 1.6 acres of existing old growth forest would be cleared in Timber Compartment 504, resulting in a 0.4 percent change in the amount of old growth forest in the compartment. Since the existing amount of old growth in compartment 504 is 7.00 percent, implementation of Alternative 2 would move the percent of old growth further away from the Forest Plan standard of 10 percent (USDA, 1987). In compartment

515, approximately 15.5 acres of existing old growth forest would be cleared, resulting in a 1.5 percent change in the amount of old growth forest in the compartment. This decrease in old growth forest from proposed Alternative 2 activities would change the old growth percentage for the compartment from 11.60 to 11.43 percent, which is above the Forest Plan standard.

Table 4.4-2
Potential Impacts to Old Growth Forest by Timber Compartment

Parameter	Alternative 1 Existing	Alternative 2 Impacts	Alternative 3 Impacts	Alternative 4 Impacts
Old Growth in Compartment 504 (acres)	413	1.6	1.6	0.1
Old Growth as Percent of Compartment 504[a]	7.00%	6.98%	6.98%	7.00%
Old Growth in Compartment 515 (acres)	1051	15.4	15.4	0.0
Old Growth as Percent of Compartment 515[a]	11.60%	11.43%	11.43%	11.60%

[a]The percentages are calculated using the area of old growth forest divided by the amount of forest land in each compartment.
Source: Forest Service, SE Group

4.4.3 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 3

Plant Communities

Implementation of this Alternative may modify the existing plant communities, but the impacts would be less than in Alternative 2. Through clearing and clearing with grading 55.5 total acres of existing plant communities would be altered. Approximately 45.8 acres of forested plant communities and 14.8 acres of non-forested plant community would be cleared for ski trails and lifts. Road and building construction would modify 3.9 acres of plant communities which would result in permanent impacts.

Threatened, Endangered, and Sensitive Plant Species

Implementation of Alternative 3 would have no effect on federally listed plant species or the sensitive plant species surveyed for under the 1997 sensitive plant survey. Under mitigation measure VM-12 (Table 2.6-1), the two sensitive plant species which were not surveyed for during the 1997 survey and the three 1999 newly listed plants, would be surveyed for prior to any disturbance relating to proposed activities. Habitat for sensitive plant species does occur within the Study Area and may be impacted by the proposed alternative.

Fragmentation, and Old Growth

Potential impacts to forest fragmentation from activities proposed in Alternative 3 are the same as described for Alternative 2 above. The actions proposed in the Bradley Meadows area under Alternative 3 would fragment a portion of the second largest interior forest patch in the FAA. The actual impact areas under Alternative 3 would be the same as Alternative 2.

Similarly, Alternative 3 would impact the same amount of old growth forest as Alternative 2, because the components of the two proposals that are the same are located in the Bradley Meadows area where the proposed old growth impacts would occur.

4.4.4 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 4

Plant Communities

Implementation of this Alternative would modify the existing plant communities, but the impacts would be less than in alternatives 2 and 3. Through clearing and clearing with grading 24.6 total acres of existing plant communities would be altered. Approximately 9.8 acres of forested plant communities and 14.8 acres of non-forested plant community would be cleared for ski trails and lifts. Road and building construction would modify 5.3 acres of plant communities which would result in permanent impacts.

Threatened, Endangered, and Sensitive Plant Species

Implementation of Alternative 4 would have no effect on federally listed plant species or the sensitive plant species surveyed for under the 1997 sensitive plant survey. Under mitigation measure VM-12 (Table 2.6-1), the two sensitive plant species which were not surveyed for during the 1997 survey and the three 1999 newly listed plants, would be surveyed for prior to any disturbance relating to proposed activities. Habitat for sensitive plant species does occur within the Study Area and may be impacted by the proposed alternative.

Fragmentation and Old Growth

Alternative 4 would not effect the fragmentation of interior forest in the FAA because the actions proposed would not alter interior forest in the Bradley Meadows or Slushman drainage areas. However, the proposed S-1 chairlift and associated runs are immediately adjacent to an interior forest patch.

Activities proposed under Alternative 4 would impact approximately 0.1 acres of old growth forest. The proposed impacts to old growth under Alternative 4 would occur in Timber Compartment 504 approximately resulting in no discernable percent change to the remaining old growth forest (see Table 4.4-2). No old growth forest would be cleared in compartment 515 under Alternative 4, resulting in no change to the existing old growth calculation of 11.6 percent for the compartment.

Figure 4-4: Alternative 2 Forest Age Class Impacts

4.4.6 FOREST PLAN CONSISTENCY

The Forest Plan standard for old growth is part of the vegetative diversity standard which states; "in order to achieve size and age diversity of vegetation, the Forest will strive to develop a timber compartment successional stage of at least 10 percent old growth timber" (USDA, 1987, pg. II-20). As presented in the analysis of fragmentation and old growth in the sections above, Timber Compartment 515 is currently at 11.60 percent which is above the Forest Plan standard for old growth. Implementation of alternatives 2 and 3 would change the old growth calculation to 11.43 percent, which is still above the Forest Plan standard of 10 percent. Alternatives 1 and 4 would not impact old growth in Compartment 515. Therefore, all of the alternatives are consistent with this Forest Plan standard for old growth in Compartment 515.

Timber Compartment 504 is currently at 7.00 percent which is below the Forest Plan Standard for old growth. Implementation of alternatives 2, 3, and 4 would clear between 0.1 and 1.6 acres of old growth, which would move the old growth percent further from the Forest Plan standard. Since the proposed old growth impacts would move conditions further from the already non-compliant 7.00 calculation, all of the Action Alternatives are inconsistent with this Forest Plan standard for Compartment 504. The Proposed Action includes a proposal for a site-specific Forest Plan amendment to exempt the project from meeting the Forest Plan standard for old growth in the affected timber compartment (see Appendix C). The Forest Plan amendment as described would result in making the Proposed Action consistent with the Forest Plan standard for old growth.

The Forest Plan standards and guidelines specify certain approaches for noxious weed control and vegetation management (USDA, 1987, pg. II-28). The Construction and Implementation plan in Appendix D to this SDEIS contains BMPs and forest service guidance designed to comply with the Forest Plan. The guidance in Appendix D includes measures for limiting distribution of noxious weed species in the Study Area through containment, gradual reduction, and prevention. The Proposed Action is consistent with these Forest Plan standards since the guidelines have been incorporated into the Proposed Action (see Appendix D).

Finally, the Action Alternatives are consistent with the Forest Plan timber standard specific to Management Area 2, which allows tree removal for reduction of safety hazards, to maintain a healthy and diverse vegetative pattern, or to permit construction or expansion of facilities and ski trails (USDA, 1987, pg. III-5).

4.5 WILDLIFE

4.5.1 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 1

Management Area Designation Change

Under Alternative 1, there would be no direct, indirect or cumulative effects to MA designation, as there would be no expansion of the SUP boundary and no need to change the current MA designation.

Threatened Species

Canada lynx (Lynx canadensis)

At a small ski area like Bridger Bowl, skiers make use of all the available terrain, often skiing through trees that might otherwise provide suitable lynx habitat. Activity occurs both during the day and throughout the night since most of the snow grooming and run maintenance occurs at night, and daily avalanche control operations are conducted during the early morning hours. Given the high level of activity occurring within the existing SUP area, it was assumed that all lynx habitat, regardless of ownership, affected by ski area features or activities is rendered unsuitable for lynx; at least during the winter months. Outside of the ski area, lynx habitat was deemed unsuitable only when all or most of the forest cover has been removed. Considering all lynx habitat in the South Bridger Lynx Analysis Unit (SB LAU), including public and private ownership, there is currently about 2,447 acres, or 20 percent in unsuitable condition (see Figure 3-5).

Denning Habitat

Alternative 1 (No Action) would have no effect on lynx denning habitat within the SB LAU, maintaining the proportion of lynx habitat in a condition suitable for denning at 22%.

Foraging Habitat

Alternative 1 (No Action) would have no effect on lynx foraging habitat.

Connectivity

Alternative 1 (No Action) would have no further impact on lynx habitat connectivity.

Bald eagle (Haliaeetus leucocephalus)

Bald eagles are observed in the Study Area primarily during fall migration, before major ski area operations begin. From late September to October there is an annual raptor migration study conducted by Hawk Watch International (HWI) from the ridge above Bridger Bowl. This study involves monitoring raptors using the Bridger migratory flyway. In addition, Bridger Bowl has been a partner in an annual fall "Raptor Festival" which includes educational programs for the general public as well as raptor viewing

from a platform located on the ridge above Bridger Bowl. Monitoring by HWI has been ongoing since 1990 and the Raptor Festival has been held annually since 1996. Bald eagles do not appear to be disturbed by the HWI surveyors as counts continue to reflect a considerable number of bald eagles using the flyway each year. The migrating raptors do not appear to be disturbed by large numbers of people viewing from the platform, as the people are located well below the flyway. HWI survey counts continue to reflect a considerable number of bald eagles using the flyway each year. Under Alternative 1, there would be no effects to bald eagles due to their limited presence in the Study Area.

Proposed Species

Gray wolf (Canis lupus)

There have been no verified sightings of wolves in the Bridger Range since their reintroduction into the Yellowstone Ecosystem as a non-essential experimental population (Pers. Comm. Joe Fontaine). Key habitat for the gray wolf includes big game winter ranges in which prey can be found in high densities (Jones 1983). The Study Area does not provide winter range for most big game species due to deep snow accumulation. Big game winter range in the Bridger Mountains is primarily located at the lower elevations on the west side of the range (Pac et al. 1991). As the wolf population expands beyond the borders of Yellowstone National Park, they could be expected to eventually reach the Bridger Range and would be expected to be associated with big game populations. Existing Bridger Bowl operations are not impacting big game in the Bridger Range therefore there would be no direct or indirect effects to the gray wolf population under Alternative 1.

Forest Service Sensitive Wildlife Species

Peregrine falcon (Falco peregrinus)

Portions of the Bridger Range represent potential peregrine falcon nesting habitat and are designated as such in the Forest Plan (USDA 1987). There are no known breeding pairs in the Bridger Range; however peregrines are seen during fall migration along Bridger ridge. Due to restriction of Bridger Bowl activities to the winter months when peregrines are not present in the area, there would be no direct or indirect effects to peregrine falcons under Alternative 1.

Flammulated owl (Otus flammeolus)

The flammulated owl is not expected to occur within the Study Area due to the lack of suitable habitat. As such, direct, indirect and cumulative effects associated with Bridger Bowl activities would be negligible. Therefore, there would be no direct or indirect effects or impact on flammulated owls under Alternative 1.

Black-backed woodpecker (Picoides arcticus)

There are no recent burns or other insect/disease conditions near the existing Bridger Bowl SUP that would provide suitable nesting and/or foraging habitat for black-backed

woodpeckers. Existing ski trails, roads and chairlift lines provide fuel breaks that reduce the potential for future fires to create suitable black-backed woodpecker habitat within the Bridger Bowl boundary. Due to the lack of suitable habitat for black-backed woodpeckers within the existing Bridger Bowl boundary, there would be no direct and indirect effects to this species under Alternative 1.

Wolverine (Gulo gulo)

Under Alternative 1 ski area operations would remain the same, with no changes inside the existing permit area and no expansion. Under this alternative the only direct and indirect effects to wolverine habitat would occur as a result of ongoing activities within the existing SUP boundary. Direct effects to wolverines under this alternative would occur primarily as a result of disturbance from high levels of human activity and subsequent displacement of wolverines from potential denning and foraging opportunities that are available within the ski area boundary. The existing SUP boundary contains approximately 435 acres of wolverine denning habitat (see Table 3.5-2). This means that about 16.8 percent of the available denning habitat in the Wolverine Analysis Area is located within the existing ski area boundary (see Figure 3-6). Since females at den sites tend to be highly sensitive to human disturbance and the denning period overlaps with the ski season, it is very unlikely that a wolverine would select a den site within the existing ski area boundary.

Indirect effects could occur due to snow compaction produced by grooming equipment and skier traffic. Snow compaction could preclude snow tunneling often associated with wolverine natal dens and resting areas. In addition, the wolverine's large foot size relative to body size gives it a competitive advantage over other predators and scavengers in deep snow conditions (Banci 1994:113). Snow compaction could reduce this advantage by allowing easier access for coyote and bobcat. Although continued recreational use within the existing ski area boundary would likely have some direct and indirect effects on wolverines as described above, these effects are expected to be minor, since wolverines have coexisted with activities in the existing ski area for several generations, and resident animals appear to have adapted to ski area activities.

Alternative 1 involves continuing permitted actions within the existing ski area boundary, with no new development and no expansion on national forest lands. Since wolverines in the Bridgers have adapted to existing ski area operations over time, it has been determined that this alternative would have no impact on wolverines.

Northern goshawk (Accipiter gentilis)

Alternative 1 would pose minimal impacts to goshawks in the Bridger Range. The most important limiting factors for goshawk populations include nesting and foraging habitat. Nesting habitat in Montana is typically composed of dense, mature to old-growth stands, on moderate slopes (15-35 percent) with northerly aspects (Hayward and Escano 1989). Although suitable nesting habitat occurs within the existing Bridger Bowl boundary, it is not likely to be impacted by general Bridger Bowl maintenance as skiers typically do not frequent these dense forested areas and there would be less concern over potential

hazards. Existing Bridger Bowl maintenance practices would not affect goshawk foraging habitat during the non-winter seasons. Goshawks may winter in the Study Area, although their presence during the ski season has not been confirmed by surveys (USFS 2000). Bridger Bowl operations in winter would not significantly impact goshawk foraging habitat. Goshawks feed on medium-sized birds and mammals such as jays, grouse, squirrels and rabbits; prey species that are common within the Bridger Bowl boundary.

Western big-eared bat (Corynorhinus townsendi)

Under Alternative 1, explosives used for avalanche control purposes could result in disturbance of hibernacula in the vicinity. However, the fact that this method of avalanche control has been practiced for multiple decades at Bridger Bowl and the lack of known caves suitable for winter roosts makes this type of disturbance a remote possibility at best in the vicinity of Bridger Bowl Ski Area. Direct impacts would occur during summer maintenance operations, and trail maintenance, including hazard tree reduction, which may remove suitable summer roosting habitat for individual bats.

Northern leopard frog (Rana pipiens)

The northern leopard frog is typically found in and around wet meadows, ponds, and riparian areas where there is an abundance of vegetation to provide cover. Outside of the breeding season they may be found in upland areas. There has been no documented presence of northern leopard frogs within the Study Area (State of Montana, Natural Heritage Program Database, 1999). The continued operation of the Bridger Bowl Ski Area is not expected to impact the northern leopard frog.

Boreal toad (*Bufo boreas boreas*)

The boreal toad is known to exist in western Montana and Yellowstone National Park. They occupy a diverse range of habitat types, from wetlands and aquatic environments during the breeding season, to sagebrush meadows and forested areas outside of the breeding season. Despite the availability of suitable habitat within the SUP area there has been no documented presence of boreal toads within the Study Area. The continued operation of the Bridger Bowl Ski Area is not expected to impact the boreal toad.

Management Indicator Species

Pine marten (Martes americana)

Under Alternative 1, marten could be attracted to Bridger Bowl facilities by human food and/or garbage. Indirect impacts could result through removal of suitable habitat components such as trees, logs, snags and rocks for Bridger Bowl hazard reduction purposes. These types of features could provide suitable denning habitat for pine marten. Snow compaction from grooming operations and skier traffic could also affect prey availability by reducing subnivean small mammal populations. However, pine marten are considered dietary generalists and opportunistic foragers (Simon 1980), and although most winter prey in western states are captured under the snow, squirrels are also hunted

in trees (USDA 1994b). Pine marten and skiers have coexisted at Bridger Bowl for several decades. There are no additional direct or indirect effects associated with Alternative 1.

Migratory birds

Under Alternative 1 small amounts of nesting habitat might be removed or degraded through general maintenance procedures such as brush clearing and hazard tree/limb removal. This type of routine maintenance work would occur along existing trails, roads, and lift lines where forest dwelling birds would not likely nest. Edge and shrub/scrub nesting birds could be affected by general maintenance however these activities are expected to affect only a negligible proportion of bird nesting habitat available within the SUP.

Game birds and mammals

Several species of game birds and mammals occur in the Study Area including blue grouse, ruffed grouse, elk, mule deer, white-tailed deer, moose, mountain goat, black bear, and mountain lion. These species have co-existed with Bridger Bowl operations for several decades and would not incur additional impacts under Alternative 1.

Road Density

Under Alternative 1, there would not be an increase in road density within the existing SUP.

Other Species of Interest

Boreal owl (Aegolius funereus)

Under Alternative 1, suitable nest trees could be removed through general maintenance of ski trails and hazard reduction. However, the likelihood of boreal owls selecting nest trees near ski lifts or trails is remote because their breeding time frame (courtship and nesting behavior begins between mid February and mid April) overlaps with the general ski season and owls would most likely seek to establish a nest site away from human activity. Under Alternative 1, there would be no new direct or indirect effects to the boreal owl.

4.5.2 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 2

Management Area Designation Change

Under Alternative 2, expansion to the north would result in approximately 217.3 acres of land currently designated MA 12 being converted to MA 2. Expansion to the south would result in the conversion of approximately 16.7 acres of MA 11 to MA 2 (USDA 1987). The Management Area 12 designation consists of forested big game habitat and includes productive forest lands that are available for timber harvest, provided that big game objectives are met (USDA 1987). The Management Area 11 designation consists

of areas that provide important habitat for summer or winter wildlife use in a variety of terrain and vegetative types as well as offering dispersed recreation opportunities (USDA 1987). Changing MA designation is an administrative process that has no direct effect on wildlife resources.

Indirect effects of changing MA designation would occur as a result of different management actions being allowed. For example, under MA 11 winter recreation activities would not be allowed on important winter range if they disrupt big game use and under MA 12 recreation activities could be restricted on important wildlife habitat (USDA 1987). Under MA 2, recreation activities would not be restricted to protect wildlife resources. By changing MA we set precedent that could lead to activities being permitted where they might not have been allowed under the original MA designation.

Changing MA 12 to MA 2 in the north expansion area would allow forest clearing and construction of roads, lifts, and ski trails in what has been designated as important wildlife habitat (USDA 1987). The proposed development in the north expansion area includes the construction of portions of one lift, five ski runs and a road in an area that is currently designated MA 12. This area provides summer and/or winter habitat for a variety of wildlife including wolverine, lynx, marten, big game, migratory birds and other species. The development proposed in this area would require tree removal and other activities, which would result in a permanent alteration of habitat for numerous species.

Changing MA 11 to MA 2 in the south expansion area would affect approximately 16.7 acres of forested big game habitat. This area provides summer range for elk, and deer, and year-round habitat for moose. There are no proposed activities that would result in habitat modification in what is currently MA 11, therefore potential impacts to big game would be minimal.

Threatened Species

Canada lynx (Lynx canadensis)

A thorough analysis of lynx habitat was completed in February 2003 for the *Biological Assessment for the Bridger Bowl Ski Area Master Development Plan* (BA), which is located in Appendix C of this SDEIS. The BA analyzed the potential effects of the 2002 Master Development Plan update which was based on the preferred alternative in the 1999 DEIS and included recently completed updates to the private lands in the base area. The U.S. Fish and Wildlife Service (USFWS) approved the BA in their *Biological Opinion on the Effects of the Bridger Bowl Ski Area Expansion on Canada Lynx* in June 2003 (USDI 2003). Since that time, the vegetation and habitat mapping in the Bridger Bowl Study Area has been updated for the 2002 Master Development Plan to reflect some additional, recently completed, projects on private lands. A description of the recent changes to the Master Plan and the current scope of the Proposed Action are contained in Section 2.3 - Modifications to the Bridger Bowl Master Plan Proposal. The Canada lynx section in this SDEIS addresses the potential impacts to lynx from the Proposed Action and the subsequent Action Alternatives. The modifications to the Master Development Plan were minor and resulted in fewer impacts to lynx habitat

overall and do not affect the determinations made by the Biological Assessment or the Biological Opinion.

Although some suitable denning habitat exists within the current ski area SUP boundary, and some would likely remain in the proposed SUP area with implementation of full expansion, for analysis purposes, a worst-case scenario was considered, assuming that necessary habitat components could be removed from intertrail tree islands, thus rendering entire blocks of existing habitat unsuitable for lynx denning purposes.

The Proposed Action would reduce the amount of suitable lynx habitat available within the Study Area. Direct impacts would include the thinning and clearing of forested cover and the removal of brush, stumps, snags, logs and lower tree limbs. The existing SUP area was not considered to contain any suitable denning or foraging habitat due to the sparse vegetation and the high level of human activity, including nighttime trail grooming and morning avalanche control; however use of the area by lynx is not precluded, especially during the summer months. Table 4.5-1 lists the acreage of mature and old growth forest impacted under each Action Alternative. Under Alternative 2 the old growth and mature subalpine and lodgepole forests in the northern expansion area would be reduced by 27.6 acres. The southern expansion area which contains mature mixed conifer forest would be reduced by 2.9 acres. The Proposed Action may disrupt the use of foraging, security and denning, and connectivity habitat, however, these modifications within the expansion areas are not likely to significantly disrupt normal behavior patterns, including breeding, feeding, or sheltering to levels resulting in injury to the Canada lynx (USDI 2003). Effects to key habitat components are discussed below.

Table 4.5-1
Impacts to Mature and Old Growth Forested Habitat within the Study Area

	Species Primarily Associated with Mature/OG Forest	Existing Forest (Alt. 1)	Alt. 2	Alt. 3	Alt. 4
Northern Expansion Area (acres[1])	elk, moose, deer, lynx, wolverine, boreal owl, northern goshawk, pine marten	193.54	- 27.6	- 27.6	- 0.0
Southern Expansion Area (acres[1])	elk, moose, deer, lynx, wolverine, boreal owl, northern goshawk, pine marten	95.17	- 2.9	- 0.0	- 2.9
Existing SUP area (acres[1])	--	497.19	- 12.7	- 12.6	- 4.8
Total (acres[1])	--	785.9	- 43.2	- 40.2	- 7.7

[1] Area totals may not agree precisely with the Study Area size of 2,574 acres due to rounding.

Denning Habitat

Alternative 2 would reduce lynx denning habitat through the clearing of mature and old growth forest for lifts, roads, and ski trails. Direct effects would result from development associated with the Proposed Action. Construction would remove approximately 30.5 acres of lynx denning habitat through the clearing of mature and old growth forest in the

northern and southern expansion areas (see Table 4.5-1). An additional 12.7 acres of mature forest would be removed from the existing SUP area. In order to provide for public safety, Bridger Bowl may need to remove lynx denning habitat components such as snags, logs, roots, stumps, and lower tree limbs, where such features could affect the safety of skiers on developed runs.

Indirect effects would impact approximately 193.5 acres of lynx denning habitat within the northern expansion area and 95.2 acres of denning habitat within the southern expansion area. Indirect effects to lynx denning habitat would result from the forest fragmentation associated with lift, run, and road construction (see Figure 4-4). Lynx have relatively specialized habitat needs and can be impacted by forest fragmentation through the creation of openings, which can confer a competitive advantage to habitat generalist species such as coyotes (Buskirk et al. 2000). Within fragmented lynx denning habitat, the potential advantage for generalist predators could increase the vulnerability of lynx kittens to predation. For purposes of this analysis, it was therefore assumed that the narrow strips of mature forest maintained between developed runs would not provide suitable lynx denning habitat. Strips of forest left between cleared runs would be narrow; in most cases less than 500 feet wide (see Figure 4-4). Forested areas cleared for lifts, roads and ski trails would remain as unsuitable lynx habitat for the life of the ski area. These areas would not be allowed to regenerate to a condition where they could provide suitable denning habitat. Additional indirect effects would include increased human activity outside of established trails since the forested habitat affected by the proposed action is relatively open compared with younger forest, and would most likely be subject to tree skiing between established runs.

Foraging Habitat

Alternative 2 includes actions that would not result in the removal of any immature lodgepole pine forest, which is identified as the primary foraging habitat of lynx. Removal of 30.5 acres of old growth and mature forests within the northern and southern expansion areas, which contain some habitat for snowshoe hares in addition to secondary prey species such as red squirrel and grouse, would directly affect lynx foraging habitat (see Table 4.5-1, Figure 4-4). Direct effects would occur in the form of actual habitat loss. Although the Proposed Action would directly remove some lynx foraging habitat, the proportion affected would be minor and would result in little or no change in the overall availability of lynx foraging habitat in the SB LAU.

Indirect effects could result from the fragmentation of relatively large contiguous blocks of mature forest habitat. Increased forest openings can facilitate access into lynx foraging habitat by more generalist predators that could compete with lynx for available prey (Buskirk et al. 2000). Resulting snow compaction from skier and groomer activity might reduce the competitive advantage lynx and snowshoe hares have over other winter wildlife residents. Generalist species tend to dominate the predator guild in more fragmented forest landscapes. The Bridger range hosts a suite of predator species, including mammalian species such as mountain lions, bobcats and coyotes, plus avian predators including golden eagles, great horned owls, red-tailed hawks and northern

goshawks, all of which include snowshoe hares in their diets, and thus compete with lynx.

The permanent habitat alteration produced by clearing of forest for lifts, roads and ski trails contributes additional indirect effects to lynx foraging habitat. Whereas natural succession would normally regenerate cleared forest land back into good foraging habitat for lynx, ski area features would be maintained in a non-forest condition in perpetuity, and thus remain as unsuitable foraging habitat. Dense growth of conifer and/or shrub habitat is not conducive to good skiing so these habitat types are not typically promoted or maintained within the ski area.

Connectivity

Alternative 2 includes development of a ski lift and trails (N2, N3, N4, N5, N6, and N8) in the north expansion area that would fragment a portion of the largest remaining contiguous block of mature and old growth forest that currently exists in the southeast Bridgers (see Figure 4-4) (Novak, 2003). Lynx would still likely find enough cover for travel and resting in the affected areas, but the structure that currently provides high quality denning habitat and some foraging opportunities would be removed or degraded through development in the north expansion area. Similar habitat connectivity degradation would occur in the south expansion area though this area contains smaller intact blocks of mature forest than the northern expansion area. Lynx habitat within the existing SUP boundary is currently quite fragmented due to naturally sparse vegetation and ski trail development, so development proposed within the existing area would not have notable effects on habitat connectivity.

Indirect effects of the Proposed Action would result from the permanent alteration of habitat due to ski area development. Removal of forest cover for the development of ski lifts, roads, trails and other facilities results in permanent openings that perpetuate the fragmentation of continuous lynx habitat. As discussed above under impacts to denning and foraging habitat, forest fragmentation could lead to a competitive advantage for more habitat generalist species over lynx. Competition between lynx and other predators such as mountain lions, bobcats, coyotes, eagles, hawks and owls can take two primary forms. Exploitation competition results when other species directly compete with lynx for prey (most notably snowshoe hares). Interference competition occurs when larger and/or more aggressive species displace lynx from kills or good hunting ground, and can even involve direct injury and/or mortality inflicted on adult lynx and their offspring (Buskirk et al. 2000). Competition effects can have notable influence on carnivore populations. Actions connected with ski area development and resulting forest fragmentation might also indirectly affect lynx. Increased forest openings, higher road densities, residential development and increased snow compaction would all further contribute to the breakdown of lynx habitat connectivity.

Habitat continuity for lynx would be degraded, but not necessarily compromised under Alternative 2. The expansion is not expected to limit the lynx from moving within or through the LAU. Lynx would likely find enough cover for travel and resting (USDI 2003).

Bald eagle (Haliaeetus leucocephalus)

Under Alternative 2, activities associated with construction of new lifts and creation of new ski trails would occur. Noise from mechanized equipment and/or explosives used in the construction process could disturb and/or displace individual birds from using the thermal air currents directly over the Study Area. The impact from such disturbance is expected to be minor and temporary. There is potential for collisions with helicopters used for construction during the fall migration period (September-October). This issue is addressed in Table 2.6-1. The USFS determined that Proposed Action would have no effect on bald eagle populations within the Study Area (USDA 2003).

Proposed Species

Gray wolf (Canis lupus)

No construction or operational impacts are expected under Alternative 2, as described under Alternative 1.

Forest Service Sensitive Wildlife Species

Peregrine falcon (Falco peregrinus)

Due to the lack of occupation of the Bridger Range by breeding pairs, direct and indirect impacts to peregrine falcons as a result of the Proposed Action would be negligible. Peregrine falcons are occasionally seen using the Bridger Mountain flyway during fall migration. However, numbers of peregrines seen during this time are low relative to other raptor species. There is a potential for collisions with helicopters used for construction during the fall migration period (September-October). This issue is addressed in Table 2.6-1 in Chapter 2.

Flammulated owl (Otus flammeolus)

Dry, open Douglas fir types represent the majority of suitable flammulated owl habitat on the GNF. Approximately 0.4 acres of Douglas fir would be impacted under Alternative 2 (see Table 4.4-1). Prevailing east and north aspects in the Study Area produce little or no suitable flammulated owl habitat. Flammulated owls have been detected on the west side of the Bridger Range, approximately 12 miles from the Study area. Home ranges of flammulated owls, including nesting and foraging areas, are relatively small averaging about 35 acres for males and probably much smaller for females (USDA, 1994a). Therefore, it is unlikely that owls utilizing available habitat on the west side of the range would venture over to the east side (including the Study Area) in search of prey or other resources. Due to the lack of suitable habitat in the Study Area, direct, indirect and cumulative effects associated with the Proposed Action would be negligible. Therefore, there would be no direct or indirect effects or impact on flammulated owls under Alternative 2.

Black-backed woodpecker (Picoides arcticus)

Direct impacts to the potential habitat of black-backed woodpeckers would occur through the removal of hazard trees (snags, dead and diseased trees) from the vicinity of the newly cleared trails. Under Alternative 2, removal of trees for creation of ski trails, construction of lifts and the construction and relocation of roads would have indirect effects on potential future black-backed woodpecker habitat by further reducing the potential for fire in the Study Area (see Table 4.4-1). Fire suppression efforts within the ski area limit the potential for wildfire to create suitable black-backed woodpecker habitat. As there is currently no suitable habitat within the Study Area, impacts to black-backed woodpeckers under Alternative 2 would be negligible.

Wolverine (Gulo gulo)

Alternative 2 involves expansion to both the north and south of the existing ski area SUP boundary. It is important to note that the analysis for wolverine in this document discusses impacts to wolverine at the Study Area scale as well as the Wolverine Analysis Area scale. The Study Area consists of the existing SUP area and the northern and southern expansion areas (approximately 2,574 acres, see Figure 2-3). The Wolverine Analysis Area, as described in Section 3.5, consists of an area roughly the size of the average home range for a female with young (approximately 34,418 acres). The Wolverine Analysis Area is depicted in Figure 3-6.

Direct effects of this alternative include habitat alteration and removal. Timber harvest proposed in the north expansion area is scheduled to occur in winter and would overlap with the wolverine denning season which could result in displacement and mortality of individuals. Under the Proposed Action, a total of approximately 276 acres of wolverine denning habitat would be impacted in the expanded ski area boundary, which equates to approximately 10.6 percent of the denning habitat available in the Wolverine Analysis Area (see Table 4.5-2).

Indirect impacts due to implementation of the Proposed Action would include the fragmentation of a portion of the largest remaining block of mature and old growth forest in the southeast Bridgers (see Figure 4-4) (Novak, 2003). Forest fragmentation can affect wolverines by breaking up security habitat, and facilitating increased competition for prey from more generalist predators. High levels of forest fragmentation could compromise the integrity of the travel corridor currently provided on the east side of the Bridger Range. Forested habitat is still largely intact on the west side of the range and could continue to provide a relatively secure travel route.

Additional indirect impacts to wolverines would include snow compaction through trail grooming and skiing. Snow compaction could preclude snow tunneling often associated with wolverine natal dens and resting areas. In addition, the wolverine's large foot size relative to body size gives it a competitive advantage over other predators and scavengers in deep snow conditions (Banci 1994). Snow compaction could reduce this advantage. Finally, noise, disturbance, and increased human activity in the expansion areas due to

both construction and ski area operation would lead to avoidance of the area and possible abandonment of dens.

Alternative 2 would impact the largest amount of wolverine habitat of all the Action Alternatives. Denning habitat would be affected in both expansion areas, and a large block of security habitat within the northern expansion area would be permanently altered. Wolverines in the Bridger Range are part of a larger population that is considered healthy and viable by Montana Fish, Wildlife and Parks personnel (Pers. Comm. B. Giddings, K. Ault). However, wolverines normally occur in low densities, and additional impacts to their habitat could potentially have detrimental effects to resident populations. However, regular use of the area may already be limited by the high level of human activity in the Study Area during the winter. Summertime use of the Study Area is limited to hiking on established trails as can be seen in Figure 2-3, therefore human activity outside of winter is typically low to moderate. For these reasons, the Proposed Action may impact individual wolverines and their habitat.

Table 4.5-2 summarizes direct and indirect impacts, by alternative, to denning habitat within the wolverine analysis area.

Table 4.5-2
Impacts to Wolverine Denning Habitat* within the Study Area

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Direct (acres[1])	0	35.5	32.1	5.1
Indirect (acres[1])	0	240.5	169.9	68.9
Total Impact (acres[1])	0	276.0	202.0	74.0

*Denning habitat includes mature forest, old growth forest, and talus within the Study Area.
[1] Area totals may not agree precisely with the Study Area size of 2,574 acres due to rounding.

Road and trail densities affect wolverines indirectly by facilitating human access, which can then have disturbance and/or displacement effects, or result in direct mortality of wolverines. Human presence can affect wolverine behavior patterns, and can potentially influence prey distribution. Road density figures were calculated for the Wolverine Analysis Area (compartments 504 and 515, plus subcompartments 04, 05, 06 and 07 of compartment 503). Table 4.5-3 summarizes increases in road density increases by alternative.

Table 4.5-3
Summary of New Road Construction and Road Density for the Proposed Action in the Wolverine Analysis Area

Parameter	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Length of Road (miles)	52.8	54.6	53.9	53.9
Road Density (mile/mile^2)	0.96	0.99	0.98	0.98

Alternative 2 would result approximately 1.8 miles of new roads within the Study Area; the greatest increase in road density of all the Action Alternatives. Several of these roads would double as ski trails during the winter ski season and some roads are concentrated in previously developed areas (see Figure 2-3).

Northern goshawk (Accipiter gentilis)

Habitat within the proposed expansion areas is comprised of mature and old growth Douglas fir, lodgepole pine, spruce, and subalpine fir. No goshawks were detected in surveys in 1996 and 2000 (USFS 2000). However, dispersing individuals may colonize the area in the future, making the amount of suitable available habitat an important component of the Study Area. Under Alternative 2, approximately 43.2 acres of goshawk nesting and foraging habitat would be removed within the Study Area (see Table 4.5-1).

Direct impacts to habitat would result from the removal of trees for the creation of ski trails and/or road and lift construction which would reduce suitable nesting habitat for goshawks in the Bridger Range. Indirect effects on foraging habitat would occur through removal of trees, snags, brush and/or down woody debris, which many of the goshawk's prey species utilize for nesting, foraging and security. In addition, goshawks are known to be sensitive to human activity and disturbance, especially during breeding and nesting (June-August). Increased human activity within the Study Area would likely cause goshawk to seek suitable nesting habitat in another location away from noise and disturbance. Goshawks are also known to occasionally use the thermal air currents produced by the Bridger Range. There is potential for direct mortality due to collisions with aircraft used during the construction phases of the proposed expansion. This issue is addressed in Table 2.6-1.

Western big-eared bat (Corynorhinus townsendi)

Impacts to western big-eared bats would be limited under Alternative 2 due to the lack of caves in the Study Area. Quality summer roosting habitat is available in the northern expansion area in mature and old growth forests. Approximately 27.6 acres of mature and old growth forest would be directly impacted as trees are removed for lift, trail and road construction (see Table 4.5-1). However, the trees removed for the project comprise only a miniscule proportion of potential summer roosting habitat available for bats in the Bridger Range. Additional direct effects would include loss of foraging habitat in riparian areas as trails are managed for vegetative growth. Mitigation measure RP-1,

which is designed to minimize adverse effects on riparian areas, would add a measure of protection to the foraging habitat of the western big-eared bat (see Table 2.6-1).

Indirect effects would result from the clearing of trees which could produce short-term improvements in foraging habitat for western big-eared bats, as this species is known to feed along forest edges (Clark et al., 1993; Freeman, 1984), which would be increased through the clearing of trees. However, the lepidopteran insects upon which the western big-eared bat feeds almost exclusively reproduce in shrubs and trees and not in grasses. Conversion of native vegetation (e.g., trees and shrubs) to grasses and rock surfaces through lift and trail construction and maintenance, and construction of new road surfaces would result in a reduction of potential foraging habitat for the western big-eared bat.

Northern leopard frog (*Rana pipiens*)

Impacts to northern leopard frog habitat would occur in the northern expansion area where suitable habitat exists in the form of seeps and wetlands (see Figure 4-2). Approximately 0.48 acres of wetlands would be impacted under the Proposed Action (see Table 4.3-2). Impacts to wetlands would consist of hand clearing of vegetation and no mechanical equipment would be used. Construction activities of all types may cause increases in sedimentation to seeps and wetlands. Mitigation measures proposed in Table 2.6-1 would help offset these impacts and implementation of BMPs would protect streams and wetlands from sedimentation and erosion. Direct mortality of individuals could occur during construction, especially during summer when the northern leopard frog is known to move upland from aquatic habitats. Impacts due to wintertime operation of the ski area are not expected to impact this species as its habitat would be located under several feet of snow.

Indirect impacts would result from the fragmentation of forest, which would create edges that the frog may be unwilling or unable to cross without sufficient cover. The northern leopard frog is not expected to reside within the Study Area due to the lack of documented presence as well as the high elevation of habitat (above 6500 feet); however, this does not preclude the likelihood of occasional presence of this species.

Boreal toad (*Bufo boreas boreas*)

Although no boreal toads have been identified within the Study Area, potential impacts to their habitat will be discussed because suitable habitat is available and the Study Area is within the range of this species. Distribution of the boreal toad is restricted to areas with suitable breeding habitat in spruce-fir forests and alpine meadows. Breeding habitat includes lakes, marshes, ponds, and bogs with sunny exposures and quiet, shallow water (CDOW World Wide Web 2004). The boreal toad is also known to occupy sagebrush meadows and forested areas outside of the breeding season which occurs from approximately May to late July. The northern expansion area provides suitable habitat for this species. Direct impacts to the suitable boreal toad habitat would include mortality of individuals during construction and maintenance in the late summer months. In addition, disturbance of breeding individuals as well as mortality to eggs could occur during clearing in wetland areas.

Indirect impacts would result from the fragmentation of forest, which would create edges that the frog may be unwilling or unable to cross without sufficient cover. Mitigation measure W-5 would require pre-construction surveys for boreal toads to prevent impacts to this species (see Table 2.6-1).

Management Indicator Species

Pine marten (Martes americana)

Impacts associated with Alternative 2 would degrade suitable denning habitat including subalpine fir, spruce, and lodgepole pine forests in the northern expansion area due to construction of ski lifts, trails, and roads. Direct impacts would include the removal of 43.2 acres of mature and old growth forested habitat, potentially destroying existing denning sites (see Table 4.5-1). The clearing of forest for ski trails would also result in forest fragmentation in the relatively undisturbed northern expansion area. Some fragmentation would also occur within the southern expansion area however, this area is naturally more open and the fragmentation of larger stands of mixed conifer forest would be significantly less than in the northern area.

Indirect impacts would include the reduction of potential denning material, such as down wood. Additional indirect impacts would result from construction activities causing noise and increased human activity which could cause temporary disturbance and displacement of pine martens utilizing the Study Area. Increased human activity associated with the new ski trails would have a similar effect as martens would most likely relocate to more undisturbed locations. Additionally, indirect impacts would occur from the expansion of the ski terrain which would result in additional snow compaction and the potential reduction in availability of subnivean prey sources.

Migratory birds

Under Alternative 2, impacts to migratory bird species would result from activities and vegetation alteration associated with the renovation of existing lifts, construction of new lifts, building of roads, and development of new ski runs. The proposed development in the north expansion area would require the clearing of mature and old growth forest to create new ski trails, and possibly some clearing of debris along the edges of the new runs (see Table 4.4-1, Figure 4-4). Proposed development and improvements within the existing SUP boundary and in the south expansion area would require some timber harvest and other vegetation manipulation, but for the most part would involve selective tree cutting in open habitat or small patches of trees. However, ski trails S5 and S4 traverse forested blocks and would require more extensive tree removal than development in the more open habitat within the south expansion area. Further, ski trails S5 and S3 cross through riparian habitat in the Slushman drainage. Riparian areas contain preferred nesting habitat for numerous bird species. Mitigation measure RP-1, which is designed to minimize adverse effects to riparian areas, would confer some protection to riparian dwelling species.

Direct effects of the Proposed Action include disturbance and/or displacement of nesting birds in the vicinity of construction. If timber harvest and subsequent construction activities occur in the spring or early summer, there is the possibility of nest abandonment, nestling mortality and resulting nest failure if snags, trees or shrubs with occupied nests are disturbed or removed. Birds in ground nests could be displaced by construction activities, and eggs or chicks might be crushed by equipment or falling trees.

Indirect effects of the proposal would result from fragmentation of forest interior habitat. Proposed development to the north involves cutting five ski trails (trails N2, N3, N4, N5, and N8) through a portion of the largest remaining patch of intact mature and old growth contiguous forest in the southeast Bridgers (see Figure 4-4) (Novak, 2003). Fragmentation of this sort would have adverse impacts on forest interior nesting birds such as the brown creeper, winter wren, golden-crowned kinglet and hermit thrush, which are relatively restricted to uncut forest habitats (Hutto and Young, 1999). Forest fragmentation can benefit habitat generalists or edge specialists such as mammalian and avian nest predators that feed on eggs and young of birds, and brood parasites that lay their eggs in the nests of other birds. Increased presence of these species is deleterious to forest interior birds, since predation, parasitism, interspecific competition and other environmental effects can collectively result in reduced nest success (Faaborg et al., 1992). The extent of edge effects can vary by habitat type, and have been estimated by various authors as ranging between 160 and 2,000 feet. Harris (1984) refers to the "three-tree-height" rule of thumb for estimating edge effects. Assuming an average tree height of roughly 54 feet, edge effects would extend 160 feet into remaining strips of forest habitat between ski runs. Forest strips with clearings on either side would have to be greater than 328 feet wide to provide habitat without negative edge effects. Forested strips remaining after development of proposed lifts, runs and road in the north expansion area would be between approximately 150 to 200 feet wide at their smallest and approximately 600 feet at their widest.

Game birds and mammals

Blue Grouse, Ruffed Grouse

Under Alternative 2, the potential effects to the blue grouse (*Dendragapus obscurus*) include removal and/or degradation of nesting habitat through vegetation manipulation planned for the expansion, disturbance/displacement of nesting grouse due to construction activities (see Figure 2-3), resulting in possible nest abandonment and/or chick mortality, and removal of hiding cover, making game birds more vulnerable to predation and hunting mortality.

The ruffed grouse (*Bonasa umbellus*), being primarily associated with aspen stands, would not likely be affected by the Proposed Action as there are no impacts to aspen within the Study Area (see Table 4.4-1).

Elk, Mule deer, White-tailed deer, Moose, Mountain goat

The Study Area provides high quality summer and fall range for elk (*Cervus elaphus*), and mule deer (*Odocoileus hemionus*), year-round habitat for moose (*Alces alces*), and possibly wintering habitat for mountain goat (*Oreamnos americanus*) (Pac, Pers. Comm., 1996). Mule deer use of the SUP area is generally seasonal, with highest use occurring in summer and fall. The Study Area provides good habitat and mule deer use was prominent during field surveys (Pac, Mackie, Jorgensen, 1991). Deer fawning may occur within the SUP area depending on the amount of snow remaining during the fawning season (May – July). White-tailed deer (*Odocoileus virginianus*) generally frequent lower elevations and are not expected to occur regularly within the Study Area. Key habitat for moose is composed of dense subalpine-fir and associated shrubby riparian areas which provide foraging vegetation.

Vegetation types in the Study Area can be roughly divided into potential foraging habitat and potential cover habitat. Cover includes both thermal cover for body temperature regulation and hiding cover (Thomas and Toweill, 1982). Under Alternative 2 there would be a permanent loss of cover habitat in the forested northern and southern expansion areas; a loss of approximately 43.2 acres. Large ungulate habitat would be altered by a permanent loss of cover habitat as forested areas are cleared for ski trails, and roads and buildings (such as lift terminals) (see Table 4.4-1). New ski trails would be maintained in a managed shrub/herbaceous condition, providing suitable foraging habitat for elk, deer, and moose.

Permanent impacts to moose, which are found in the Study Area year round, would include displacement of individuals that may be utilizing the forested areas in the northern expansion area for cover and security. Moose would most likely move away from the increased human activity to quieter, more isolated locations.

Permanent habitat conversion would occur in areas not currently receiving high human use. This conversion would result in an increased amount of edge habitat, an increase in potential foraging habitat, and a decrease in cover. The effectiveness of edge as foraging habitat would be affected by the amount and treatment of slash created during trail construction. Slash left piled along newly constructed ski trails could obstruct ungulate movement and limit use of the new areas. Removing or reducing the slash or creating cleared access trails between the new ski trails and the surrounding forest would reduce impacts.

Indirect impacts to big game include potential disturbance and/or displacement of moose, elk, and deer during calving/fawning season due to construction activities and recreation. Security cover would be reduced as trees, shrubs and brush are removed, increasing ungulate vulnerability to predation and hunting mortality. Although habitat alteration and increased human activity would result from the Proposed Action, suitable habitat would remain available within the SUP area.

Road Density

Road densities are of concern to elk habitat management because motorized use of roads can produce disturbance effects that result in their displacement. Effective elk security cover is modified by open roads. The greater the density of open roads within an area, the less effective is hiding cover in providing security for elk (USDA 1987). Montana Fish, Wildlife, and Parks (FWP) recommends that the Forest Service manage for an open road density of one mile or less per square mile of habitat to be consistent with the Elk Management Plan guidelines (IGBC 2003).

The Gallatin Forest Plan contains a forest-wide standard that effective habitat ratings of at least 70 percent should be maintained for timber sale and road construction activities (USDA 1987). The elk habitat effectiveness index (HEI) is based on open road densities and cover availability. An HEI rating of 0.70 is the minimum allowed to meet the Forest Plan standard. The Forest Plan standard for HEI is applied at the compartment level, since timber compartments are ecological units defined by topographic and hydrologic features, and generally encompass an area representative of elk summer range.

The Proposed Action includes timber compartments 504 and 515. Table 4.5-4 displays the changes to road miles, road density, and elk HEI. Compartment 504 currently has an open road density of approximately 1.64 miles per square mile, which equates to an HEI of 0.54. Compartment 515 currently has an open road density of approximately 1.96 miles per square mile, which equates to an HEI of 0.50. The HEIs for timber compartments 504 and 515 are below the minimum standard of 0.70 established in the Forest Plan. Under Alternative 2, the road density within the compartment 504 would increase to 1.78 miles per square mile, an increase of approximately 0.14 miles per square mile. The HEI for Compartment 504 would be reduced from 0.54 to 0.52, pushing the HEI further out of compliance with the Forest Plan (see Table 4.5-4). The road density within compartment 515 would not increase from 1.96 miles per square mile therefore the HEI for Compartment 515 would remain the same as Alternative 1 (see Table 4.5-4).

Therefore, while road density would increase within the Study Area, it is not enough to alter the current HEI for compartment 504 or 515.

Table 4.5-4
Changes Road Miles, Road Density, and Elk HEI by Alternative

Parameter	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Total Road Miles in C-504	19.8	21.6	20.9	20.9
Road Density in C-504	1.64	1.78	1.73	1.73
Elk HEI in C-504	0.54	0.52	0.53	0.53
Total Road Miles in C-515	32.5	32.5	32.5	32.5
Road Density in C-515	1.96	1.96	1.96	1.96
Elk HEI in C-515	0.50	0.50	0.50	0.50

Black bear, Mountain lion

Black bear (*Ursus americanus*) are likely to use the habitat within the Study Area in spring for lush vegetation and in the fall for pine nuts and animal remains from hunter kills. Black bears are habitat generalists so the entire SUP currently in vegetation can be considered habitat. The Proposed Action would increase the likelihood of human-bear interactions; however, since the vast majority of human use would occur during the bears' denning period, the increased potential for conflict is minor. Mitigation measures designed to reduce the availability of garbage around the base area would aid in reducing potential human-bear interactions (see Table 2.6-1). Clearing of forest for ski trails could actually improve the habitat value of these areas by increasing the quantity of berry-producing shrubs between maintenance. In addition, cleared ski trails would increase foraging habitat for large ungulates, attracting more browsers to the Study Area during the summer and fall seasons and providing the black bear with an increased abundance in prey. However, security cover would be reduced and the increased fragmentation of forest habitat in the Study Area could hamper normal black bear movement.

Mountain lions (*Felis concolor*) most likely use the Study Area in association with the presence of ungulates. The Study Area provides winter habitat only for moose while other big game species such as deer and elk move to lower elevations. Potential direct impacts to mountain lions include alteration of habitat, alteration in prey availability, and disturbance as a result of construction activities. The conversion of forested areas to shrub and herbaceous habitats for ski trail development may increase the suitable habitat for deer and elk and thus may improve the foraging value of the Study Area for mountain lions in the summertime. In contrast, the reduction of forest cover for new or wider ski trails could disrupt the normal movement patterns of mountain lions and discourage their use of the area. Mountain lions generally avoid areas of human activity, so construction of project components is likely to repel cougars that would normally use the Study Area. Summertime maintenance of trails and lifts would be infrequent but could alter use of the area by deer and elk, the mountain lion's primary prey. In addition, recreational activity

could impact use of the area by mountain lion although summertime use of the Study Area would be limited so this would be a minor impact.

Other Species of Interest

Boreal owl (Aegolius funereus)

Under Alternative 2, direct impacts to suitable boreal owl habitat would occur as trees are cleared for the creation of ski trails, construction of lifts and construction and the relocation of roads. Some large trees and snags within boreal owl nesting habitat would be removed under Alternative 2 (see Table 4.4-1). Indirect impacts would occur as a result of snow compaction and its associated impacts to small mammal populations, which comprise the majority of the boreal owl's diet. Survey efforts by Brelsford (1992) in Pine Creek and Slushman Creek drainage failed to detect boreal owl presence in the Bridger Range. However, the limited nature of this survey and lack of surveys elsewhere in the Bridger Mountains leaves the presence of boreal owls in the Study Area unknown. Although the Proposed Action would alter boreal owl habitat, Region-wide surveys have indicated that this species is more common than believed when it was listed as "sensitive". Based on multi-year survey results, the boreal owl was removed from the Northern Region Sensitive Species list in March 1999 (USFS 1999).

4.5.3 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 3

Management Area Designation Change

Under Alternative 3, the effects of MA change would be similar to Alternative 2, but would only involve the change in MA 12; e.g., 217.3 acres converted to MA 2.

Threatened Species

Canada lynx (Lynx canadensis)

Denning Habitat

Alternative 3 would have similar effects on lynx denning habitat, except that there would be no development in the south expansion area. Proposed expansion to the north would remove approximately 27.6 acres of mature and old growth forest and indirectly impact approximately 193.54 acres (see Table 4.5-1). Alternative 3 would impact fewer acres than the Proposed Action.

Foraging Habitat

Alternative 3 would have the same direct and indirect effects on foraging habitat as Alternative 2, but would affect only the area within the existing SUP and the north expansion area, and thus a slightly smaller proportion of foraging habitat would be impacted. No impacts to immature lodgepole pine forest, which is the primary foraging habitat of lynx, would occur under Alternative 3. Indirect effects would be similar to those described for Alternative 2.

Connectivity

Alternative 3, with development in the existing SUP boundary and north expansion area, would have the same impacts to the large block of continuous mature forest in the LAU as Alternative 2, but the smaller patch of mature forest in the south expansion area would not be affected. Indirect effects would be similar to those described for Alternative 2.

Bald eagle (Haliaeetus leucocephalus)

Impacts to Bald Eagle under Alternative 3 would be as described under Alternative 2.

Proposed Species

Gray wolf (Canis lupus)

No construction or operational impacts to gray wolf are expected under Alternative 3, as described under Alternative 2.

Forest Service Sensitive Wildlife Species

Peregrine falcon (Falco peregrinus)

Impacts to peregrine falcons under Alternative 3 would be similar to those described under Alternative 2 with the exception that there would be no expansion of the SUP boundary to the south, and therefore, fewer impacts overall.

Flammulated owl (Otus flammeolus)

Impacts to flammulated owl under Alternative 3 would be similar to those described under Alternative 2 with the exception that there would be no expansion of the SUP boundary to the south.

Black-backed woodpecker (Picoides arcticus)

Impacts to black-backed woodpecker under Alternative 3 would be similar to those described under Alternative 2 with the exception that there would be no expansion of the SUP boundary to the south, and therefore, fewer impacts overall.

Wolverine (Gulo gulo)

Alternative 3 involves ski area expansion to the north, but not to the south of the existing SUP boundary. Direct and indirect effects to wolverines under this alternative would be similar to those described for Alternative 2, since the higher quality wolverine habitat is located in the north expansion area. Under this alternative, approximately 202 acres of wolverine denning habitat would be impacted in the new ski area boundary, which equates to about 7.8 percent of the denning habitat available in the Wolverine Analysis Area (see Table 4.5-2). Approximately 1.1 miles of new road would be constructed with

this alternative, bringing road density in the Wolverine Analysis Area to 0.98 miles per square mile, slightly less than the Proposed Action.

Northern goshawk (Accipiter gentilis)

Under Alternative 3 approximately 40.2 acres of nesting and foraging habitat would be removed (see Table 4.5-1; Figure 2-3). Direct and indirect effects to goshawks associated with the removal of nesting and foraging habitat would be similar to those described under Alternative 2 with the exception that there would be no expansion of the SUP boundary to the south.

Western big-eared bat (Corynorhinus townsendi)

Impacts to the western big-eared bat under Alternative 3 would be similar to those described under Alternative 2 with the exception that there would be no expansion of the SUP boundary to the south.

Northern leopard frog (Rana pipiens)

Because the southern expansion area does not contain suitable habitat for the northern leopard frog, potential impacts to this species would be as described for the northern expansion area under Alternative 2.

Boreal toad (Bufo boreas boreas)

Because the southern expansion area does not contain suitable habitat for the boreal toad, potential impacts to this species would be as described for the northern expansion area under Alternative 2.

Management Indicator Species

Pine marten (Martes americana)

Alternative 3 would impact approximately 27.6 acres of suitable pine marten habitat in the northern expansion area (see Table 4.5-1). This area provides high quality marten habitat in the form of mature and old growth subalpine fir and lodgepole pine forests with north and northeast aspects (see Table 4.4-1; Figure 4-4). Impacts under Alternative 3 would be as described under Alternative 2 with the exception that there would be no development in the southern expansion area.

Migratory birds

Under Alternative 3, effects to migratory bird species would be comparable to those listed for Alternative 2, but would occur only within the existing SUP area and in the north expansion area; i.e., under this alternative, no expansion, no development, and hence no impacts would occur to the south of the existing SUP area (see Table 4.4-1). Proposed expansion to the north involves considerably more habitat alteration than development within the existing boundary or to the south. The north expansion area has by far the greatest amount of forest interior habitat that could be affected by the proposed

action, therefore direct and indirect effects of Alternative 3 would be similar to Alternative 2 for forest interior migratory bird species. Mitigation measure RP-1, which is designed to minimize adverse effects on riparian areas, would aid in the protection of habitat and individuals (see Table 2.6-1).

Game birds and mammals

Blue and Ruffed grouse (*Dendragapus obscurus, Bonasa umbellus*)

Impacts to blue grouse under Alternative 3 would be similar but less than those described for Alternative 2 because there would be no development in the proposed southern expansion area.

No impacts to ruffed grouse are expected to occur under Alternative 3 as there would be no impacts to its primary habitat, quaking aspen (see Table 4.4-1).

Elk, Mule deer, White-tailed deer, Moose, Mountain goat

Impacts to elk, mule deer, white-tailed deer, moose, and mountain goat under Alternative 3 would be similar but less than those described for Alternative 2 because there would be no development in the proposed southern expansion area.

Road Density

Under Alternative 3, the road density for Compartment 504 would be approximately 1.73 miles/miles^2, an increase of 0.09 miles/miles^2 over existing conditions (see Table 4.5-4). The road density for Compartment 515 would not increase over existing conditions. Alternative 3 would not alter the elk Habitat Effectiveness Index for Compartment 515. The HEI for Compartment 504 would be reduced from 0.54 to 0.53, pushing the HEI further out of compliance with the Forest Plan (see Table 4.5-4).

Black bear, Cougar

Impacts to black bear and cougar under Alternative 3 would be similar but less than those described for Alternative 2 because there would be no development in the proposed southern expansion area.

Other Species of Interest

Boreal owl (Aegolius funereus)

Impacts to boreal owl under Alternative 3 would be the same as Alternative 2 with the exception that there would be no expansion of the SUP boundary to the south.

4.5.4 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 4

Management Area Designation Change

Under Alternative 4, the effects of MA change would be the same as under Alternative 2, but would only involve the change in MA 11; e.g., approximately 16.7 acres converted to MA 2.

Threatened Species

Canada lynx (Lynx canadensis)

Denning Habitat

Alternative 4 would have considerably less impact on lynx denning habitat, with approximately 2.9 acres of mature and old growth mixed conifer forest that would be directly impacted by the development of ski runs in the southern expansion area. None of the higher quality denning habitat north of the existing ski area SUP would be affected under this alternative. The impacts to denning habitat from development in the south expansion area would reduce the total proportion for the LAU by 0.11 percent from the 22 percent currently available.

Foraging Habitat

Alternative 4 would impact approximately 0.3 acres of immature Douglas fir forest in the south expansion area. There would be no removal of immature lodgepole pine in this alternative. Direct effects of this alternative would impact less foraging habitat than under either alternatives 2 or 3. The relatively small impacts to forested habitat in the southern expansion area would result in fewer effects to lynx foraging habitat than alternatives 2 or 3.

Connectivity

Alternative 4 would have some fragmentation effects on a smaller patch of mature forest located in the south expansion area, but would not disturb the large block of mature and old growth habitat in the northern expansion area. Indirect effects would still result from the permanent habitat alteration of mature forest in the south expansion area, but would be to a lesser extent than with either alternatives 2 or 3, since less mature forest and a smaller patch of continuous forest would be impacted.

Bald eagle (Haliaeetus leucocephalus)

Impacts to Bald Eagle under Alternative 4 would be similar to those describe under Alternative 2 with the exception that there would be no expansion of the SUP boundary to the north.

Proposed Species

Gray wolf (Canis lupus)

No construction or operational impacts are expected under Alternative 4, as described under Alternative 1.

Forest Service Sensitive Wildlife Species

Peregrine falcon (Falco peregrinus)

Impacts to peregrine falcons under Alternative 4 would be similar to those described under Alternative 2 with the exception that there would be no expansion of the SUP boundary to the north, and therefore, fewer impacts overall.

Flammulated owl (Otus flammeolus)

Impacts to flammulated owl under Alternative 4 would be similar to those described under Alternative 2 with the exception that there would be no expansion of the SUP boundary to the north, and therefore, fewer impacts overall.

Black-backed woodpecker (Picoides arcticus)

Impacts to black-backed woodpecker under Alternative 4 would be similar to those described under Alternative 2 with the exception that there would be no expansion of the SUP boundary to the north, and therefore, fewer impacts overall.

Wolverine (Gulo gulo)

Alternative 4 involves ski area expansion to the south, but not to the north of the existing SUP boundary. Direct and indirect effects to wolverines under this alternative would be similar to those described for Alternative 2, however, since the higher quality wolverine habitat is located in the north expansion area, fewer impacts overall would be expected. Under this alternative, approximately 74 acres of wolverine denning habitat would be impacted in the new ski area boundary, which equates to about 2.9 percent of the denning habitat available in the wolverine analysis area. Approximately 1.1 miles of new road would be constructed with this alternative, bringing road density in the Study Area to 0.98 miles per square mile, slightly less than the Proposed Action.

Northern goshawk (Accipiter gentilis)

Under Alternative 4 approximately 7.7 acres of nesting and foraging habitat would be removed (see Table 4.5-1; Figure 2-3). Direct and indirect effects to goshawks associated with the removal of nesting and foraging habitat would be similar to those described under Alternative 2 with the exception that there would be no expansion of the SUP boundary to the north.

Western big-eared bat (Corynorhinus townsendi)

Impacts to the western big-eared bat under Alternative 4 would be similar to those described under Alternative 2 with the exception that there would be no expansion of the SUP boundary to the north, and therefore, fewer impacts overall.

Northern leopard frog (Rana pipiens)

Because the southern expansion area does not contain suitable habitat for the northern leopard frog, there would be no impacts to this species under Alternative 4.

Boreal toad (Bufo boreas boreas)

Because the southern expansion area does not contain suitable habitat for the boreal toad, there would be no impacts to this species under Alternative 4.

Management Indicator Species

Pine marten (Martes americana)

Alternative 4 would impact approximately 2.9 acres of suitable pine marten habitat in the southern expansion area (see Table 4.5-1). This area provides only marginal marten habitat in the form of mature Douglas fir and mixed conifer forests with east and southeast aspects. There would be fewer direct and indirect impacts under Alternative 4 than those disclosed for alternatives 2 and 3, as only a small portion of marginal habitat would be affected; leaving the quality habitat in the northern expansion area undisturbed.

Migratory birds

Under Alternative 4, effects to migratory bird species would occur only within the existing SUP boundary and in the south expansion area; and hence no impacts would occur to the north of the existing SUP area. Development in the existing area and to the south involves mainly non-forest and sparsely forested habitat, therefore there would be little habitat disturbance and effects would be primarily limited to the direct impacts associated with initial construction activities. Mitigation measure RP-1, which is designed to minimize adverse effects on riparian areas, would aid in the protection of habitat and individuals (see Table 2.6-1).

Game birds and mammals

Blue and Ruffed grouse (Dendragapus obscurus, Bonasa umbellus)

Impacts to blue grouse under Alternative 4 would be similar but less than those described for alternatives 2 and 3 because there would be no development in the proposed northern expansion area.

No impacts to ruffed grouse are expected to occur under Alternative 4 as there would be no impacts to its primary habitat; quaking aspen (see Table 4.4-1).

Elk, Mule deer, White-tailed deer, Moose, Mountain goat

Impacts to elk, mule deer, white-tailed deer, moose, and mountain goat under Alternative 4 would be similar but less than those described for alternatives 2 and 3 because there would be no development in the proposed northern expansion area.

Black bear, Cougar

Impacts to black bear and cougar under Alternative 4 would be similar but less than those described for alternatives 2 and 3 because there would be no development in the proposed northern expansion area.

Road Density

Under Alternative 4, the road density for Compartment 504 would be approximately 1.73 miles/miles^2, an increase of 0.09 miles/miles^2 over existing conditions (see Table 4.5-4). The road density for Compartment 515 would not increase over existing conditions. Alternative 4 would not alter the elk Habitat Effectiveness Index for Compartment 515. The HEI for Compartment 504 would be reduced from 0.54 to 0.53, pushing the HEI further out of compliance with the Forest Plan (see Table 4.5-4).

Other Species of Interest

Boreal owl (Aegolius funereus)

Impacts to boreal owl under Alternative 4 would be the same as Alternative 2 with the exception that there would be no expansion of the SUP boundary to the north. Since the southern expansion area contains marginal boreal owl nesting habitat impacts are expected to be negligible.

4.5.5 FOREST PLAN CONSISTENCY

Under the current Forest Plan Management Area (MA) designation, development associated with ski area expansion to the north would be inconsistent with the MA 12 primary goal to maintain and improve the vegetative condition to provide habitat for a diversity of wildlife species. The Proposed Action includes a Forest Plan amendment to change the MA designation in the northwest expansion area from MA 12 (important habitat for wildlife) to MA 2 (Developed Ski Area) (see Chapter 2 and Appendix C). In addition, a small amount of MA 11 (big game emphasis) would be added to the ski area boundary in the southeast corner. The Proposed Action also included a Forest Plan amendment to change this small parcel designation from MA 11 to MA 2. No vegetation changes are proposed within this small parcel, and the area would continue to provide forested big game habitat. The proposed Forest Plan amendments to shift management area designation as described would make the Proposed Action consistent with the Forest Plan.

The Forest Plan contains a forest-wide standard to analyze elk habitat security as it is affected by timber harvest and road construction activities in accordance with the 1982

Elk Logging Study Annual Report, and to maintain an elk habitat effectiveness index (HEI) of at least 0.70 (USDA 1987). Since the proposed action involves both timber harvest and road construction, HEI calculations were evaluated for affected timber compartments (504 and 515). Both compartments are currently below Forest Plan standard, with HEI values of 0.54 and 0.50 respectively. New road construction associated with the proposed action would further reduce HEI in compartment 504. The Proposed Action includes a site-specific amendment to the Forest Plan to exempt the project from meeting the Forest Plan standard for HEI in Timber Compartment 504.

4.6 FISHERIES

In order to analyze potential downstream impacts to fish habitat, annual sediment yields were calculated by the GNF hydrologist (Story, 2003) for the existing conditions and proposed activities in alternatives 2, 3, and 4 using the R1/R4 sediment model (Cline et al., 1981). The scale of the area modeled for sediment impacts used to support for fisheries analysis is the SF Brackett Creek Watershed and the Upper Bridger Creek Watershed. For the purpose of this analysis, the Upper Bridger Creek Watershed includes Upper Bridger Creek, Maynard Creek, and Slushman Creek. The actual effects of additional delivery of fine sediment on fish habitat quality would be dependent on precipitation, streamflow, how quickly exposed soil is stabilized, and how the sediment is delivered to and routed within the stream during these activities. The effects of this additional sediment delivery on fish spawning and rearing habitat was estimated using a modification of the Fish/Sediment model which estimate changes in substrate composition that results from changes in sediment delivery rates (Stowell et al., 1983). This modification more accurately reflects sediment routing relationships of geologies found on the GNF.

4.6.1 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 1

There would be no change to the existing condition of fish habitat quality or quantity within the Upper Bridger Creek and SF Brackett Creek watersheds under Alternative 1 because no activities are proposed. According to the 1999 MOU discussed in Chapter 3, the GNF sediment guideline for streams with sensitive fish species is to maintain aquatic habitat at or above 90 percent of optimum conditions. Guidance from the GNF for assessing compliance with this guideline is to ensure that sediment delivery to streams does not exceed 30 percent over natural conditions on an annual basis. The modeled sediment delivery rate to SF Brackett Creek for existing conditions is 8.2 percent over natural conditions for SF Brackett Creek, which is well below 30 percent threshold set by the GNF to ensure that habitat is maintained at 90 percent of optimum conditions. Based on guidance in the 1999 MOU, Alternative 1 would not have any significant effects on Yellowstone cutthroat trout or their habitat in SF Brackett Creek because Alternative 1 would not change sediment yields to SF Brackett Creek and it meets the guidance of the 1999 MOU.

No populations of westslope cutthroat trout or Artic grayling have been documented in the Upper Bridger Creek or SF Brackett Creek watersheds, but habitat for westslope cutthroat trout is present downstream of Upper Bridger Creek. The three tributaries to the mainstem of Bridger Creek (Slushman, Maynard, and Upper Bridger) are all considered Class D streams by the GNF since they do not have any documented fish presence. According to GNF guidelines, to protect Class D streams, sediment increases should not exceed 100 percent above natural rates. Alternative 1 would not have any direct impacts to special status fish populations in the Upper Bridger Creek watershed because no special status fish are present in the watershed and the alternative would not change sediment yield rates. According to estimates from the R1R4 model, the existing sediment yield to the three tributaries to the mainstem of Bridger Creek range from 8 to 77 percent above natural conditions. Alternative 1 would not have any significant effects

on westslope cutthroat trout habitat in Lower Bridger Creek because Alternative 1 would not change sediment yields, which are within the GNF standard for Class D streams

4.6.2 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 2

Potential direct effects from implementation of Alternative 2 include the mortality of fish or destruction of fish habitat, such as a fuel spill from construction equipment directly in SF Brackett or Upper Bridger Creeks that could affect downstream fish populations. The potential for this to occur is extremely low to non-existent as construction equipment would not be working immediately adjacent to streams. Any work within the Stream Management Zone (SMZ) would follow any applicable Mitigation measures listed in Chapter 2 (see Table 2.6-1) and BMPs listed in the Implementation and Monitoring Plan in Appendix D.

Indirect effects would be those resulting in changes to fish habitat due to changes in the physical environment, such as the potential for accelerated sediment delivery in the lower gradient stream reaches to affect the reproductive success of trout, see Section 4.2 – Soil Resources for more details on changes in sediment yield from the alternatives. Elevated levels of fine sediment (material<6.3 mm in diameter) have been shown to affect salmonid habitat used for spawning, rearing, and overwintering (Chapman and McLeod, 1987). Pollution intolerant macroinvertebrate abundance, survival of embryos to emergence, pool volume, and quantity of overwintering habitat for salmonids are correlated with the level of fine sediment in streams (Chapman and McLeod, 1987). Accelerated sediment delivery is expected to increase approximately 1.5 to 3.9 percent over existing conditions during construction activities, however this rate would drop once construction was complete and trails were stabilized and is not expected to have significant effects to MIS or sensitive fish habitat (see Table 4.6-1).

Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*)

Direct impacts to the Yellowstone cutthroat trout are not expected to occur under Alternative 2 because no in-stream work is proposed in SF Brackett Creek and the potential for fuel spills into the waterbody is extremely low.

Maximum sediment delivery to SF Brackett Creek from summer road and ski trail construction proposed under Alternative 2 is estimated to increase sediment delivery rates to 10.1 percent over natural conditions, or 1.8 percent over existing rates (see Table 4.6-1). This delivery rate would decrease to 9.3 percent over natural conditions within 2 years after construction in 2007. This would translate to less than a 0.5 percent annual increase in fine sediment deposited within SF Brackett Creek during the years of implementation. This rate is estimated to fall to 0.2 percent over existing levels within two years. The cumulative rate of sediment deposition in 2011 is predicted to be less than 2 percent with no downstream routing being considered (see Table 4.6-1). This level of sediment deposition within SF Brackett Creek would have extremely limited, if any, negative effect on Yellowstone cutthroat trout habitat within the drainage. Furthermore, because sediment delivery to SF Brackett Creek would not exceed 30 percent over natural levels under Alternative 2, aquatic habitat would not likely be

degraded below 90 percent of optimum conditions. Based on the sediment modeling, Alternative 2 would not have any significant effects on Yellowstone cutthroat trout or their habitat in SF Brackett Creek because changes in sediment yields would comply with the guidance of the 1999 MOU.

Table 4.6-1
Existing and Estimated Annual Sediment Delivered to the South Fork Brackett Creek for Alternatives 2 and 3

Watershed	Year	Sediment Yield Increase from Natural Rate (tons/year)	Total Combined Sediment Yield (tons/year)	Increase Over Natural Rates (percent)	Incremental Change in Percent Fines in Channel	
					Annual	Cumulative
Existing Conditions	2004	6.8	89.8	8.2	0.0	0.0
Implementation Alternatives 2 & 3	2005	8.4	91.4	10.1	0.4	0.4
	2006	7.9	90.9	9.5	0.3	0.7
	2007	7.7	90.7	9.3	0.2	0.9
	2008	7.6	90.6	9.2	0.2	1.1
	2009	7.2	90.2	8.7	0.1	1.2
	2010	7.1	90.1	8.6	0.1	1.3
	2011	7.0	90.0	8.4	0.0	1.3

*Table based on implementation beginning in 2004. However actual implementation may vary.
Source: USFS

Westslope cutthroat trout (*Oncorhynchus lewisi*)

Direct impacts to the westslope cutthroat trout are not expected to occur under Alternative 2 because the proposed culvert crossing in Slushman Creek is in a location with no documented fish presence or habitat and the potential for fuel spills into the waterbody is extremely low.

Suitable habitat for westslope cutthroat trout exists downstream of the Study Area within Bridger Creek. Development of ski trails and roads in the Study Area would further increase sedimentation into Bridger Creek drainage potentially reducing the quality of aquatic habitat if westslope cutthroat trout were to be reintroduced into this portion of their historic range. However, the maximum sediment delivery due to construction activities proposed under Alternative 2 is estimated to increase delivery rates in the three tributaries to the mainstem of Bridger Creek by 1.5 to 3.5 tons per year, increasing rates over natural conditions to 28.4 to 83.9 percent. Increases in sediment yield as a result of activities proposed under Alternative 2 would not exceed the 100 percent above natural rates guidelines of the GNF. Therefore, this level of sediment delivery and deposition within Upper Bridger Creek Watershed would have extremely limited, if any, negative effect on westslope cutthroat trout habitat.

Arctic grayling (*Thymallus arcticus*)

The Proposed Action is not expected to impact the fluvial arctic grayling as no suitable habitat exists within the Study Area. In addition, there has been no documented presence of this species within the Bridger Creek drainage.

4.6.3 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 3

Potential effects to Yellowstone cutthroat trout and Arctic grayling under the implementation of Alternative 3 would be the same as those described under Alternative 2. Potential effects to MIS and sensitive species (westslope cutthroat trout) habitat from Alternative 3 would be slightly less than under Alternative 2 because there would be no development in the Slushman drainage. Potential increases in sediment yields to Maynard and Upper Bridger Creeks would be the same as Alternative 2, which would be in compliance with GNF guidelines for Class D streams.

4.6.4 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 4

Alternative 4 would not entail any development within the SF Brackett Creek watershed, therefore there would be no impacts to MIS or sensitive species (Yellowstone cutthroat trout) from increased sediment delivery rates or reduced biological productivity within the SF Brackett Creek watershed. Potential effects to MIS and sensitive species (westslope cutthroat trout and Arctic grayling) under the implementation of Alternative 4 would be the same as described under Alternative 2, although sediment delivery rates in Maynard Creek and Upper Bridger Creek would be slightly less than under Alternative 2.

4.6.5 FOREST PLAN CONSISTENCY

The Forest Plan identifies a goal associated with fish habitat management that is "to maintain and enhance fish habitat to provide for an increased fish population" (II-1). The plan further refines this direction by providing Forest Plan implementation guidelines that identify specific management requirements for various stream classes. SF Brackett Creek is classified as a Class A stream by the GNF due to the presence of sensitive fish species. Class A streams are to be managed at a level which provides at least 90 percent of their potential habitat capability. Based on inspections of fish habitat and riparian area conditions, along with current sediment delivery rate estimates, SF Brackett Creek currently provides habitat at a level greater than 90 percent capability requirement. Analysis of potential increases in sediment delivery rates due to implementation of the Proposed Action indicates that the 90 percent capacity requirement would be met, and therefore, the Proposed Action would be consistent with this Forest Plan Standard.

According to Standard 6.a.15 in the Forest Plan, any structures that are installed in fish-bearing streams shall be designed to allow for upstream fish passage. The one stream crossing that is included in the Proposed Action would occur on Slushman Creek near the point in the stream where it transitions from perennial flowing to intermittent. As disclosed in the Fisheries Section in Chapter 3 of this document, there is no documented presence of fish in Slushman Creek. Therefore, implementation of the Proposed Action would be consistent with this Forest Plan Standard (II-19).

4.7 ROADLESS

The analysis of the action alternatives encompasses potential site-specific impacts, including those on the roadless characteristics and wilderness features, stemming from the implementation of the proposed management practices designed to achieve the goals and objectives associated with non-wilderness management.

4.7.1 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 1

Under Alternative 1 expansion of Bridger Bowl into the Slushman and South Fork Brackett drainages would not occur. The Bridger Inventoried Roadless Area (IRA) would not be impacted by the development of a lift, ski trails, or roads. This area would retain its availability for future wilderness consideration and opportunities for semi-primitive recreation would continue from Bridger Canyon. Access to these NFS lands cannot be obtained via Brackett or Middle Cottonwood creeks.

Skiers and snowboarders would continue entering the Slushman drainage that is within the Bridger IRA either by skiing out of bounds or hiking up the mountain through private land from Bridger Canyon. It is also possible to obtain access through NFS lands; the most common areas are Brackett and Middle Cottonwood drainages.

4.7.2 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 2

The proposed ski area expansion to the south of the existing Study Area would directly affect the Bridger IRA. The proposed new Study Area boundary would encompass about 101 acres of the IRA in the Slushman Drainage. A portion of the S-1 chairlift and portions of ski trails 1S, 2S, and 3S would be within the IRA, resulting in approximately 1.4 acres of vegetation removal and 0.7 acres of grading. Since the trails would be located on open meadows and rock outcroppings, no significant amount of tree cover would be removed to develop this area.

The following provides a discussion of impacts to the six wilderness attributes of the undeveloped IRA lands adjacent to the Bridger Bowl SUP:

Natural Appearance and Natural Integrity (direct and indirect effects)

Construction of the chairlift and ski trails in the Slushman drainage area would affect both the apparent naturalness and natural integrity, as these activities represent human manipulation of the environment. Some trees would need to be removed for the Slushman lift (S-1). The new chairlift would be apparent to all visitors. The lift corridor and ski trails would be kept clear of trees for the life of the Special Use Permit, so recovery of vegetation within the lift alignment and ski trails would be limited to grasses and low shrubs. This level of vegetation clearing does not appear to be natural and would detract from the natural integrity of the area.

Remoteness and Solitude (direct and indirect effects)

Tree cutting and lift construction would decrease opportunities for solitude and remoteness in the cutting area, as the sights and sounds of human activity would be readily apparent during clearing and construction. These effects would be short in duration. The use of the lift and the trails within the roadless area would have an impact on wintertime feelings of remoteness and solitude for the life of the SUP.

Special Features and Boundary Management (direct and indirect effects)

There are no known risks that the current use of the ridge or the planned expansion of the ski area would have any effect on the raptor fall migration route. See Section 4.5 - Wildlife for more details on potential effects to the raptor fall migration route. There are no other known special features within the proposed expansion area.

The boundary of the roadless area would be modified with implementation of Alternative 2. The roadless boundary within the proposed project area to the south follows Slushman Creek. Currently, skiers and snowboarders do not generally ski south beyond Slushman Creek. It is not anticipated that implementation of the action alternatives would encourage skiing beyond Slushman Creek. There would be no impacts to the Bradley Meadows area.

4.7.3 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 3

Under Alternative 3 expansion of Bridger Bowl into the Slushman and South Fork Brackett drainages would not occur. The Bridger IRA would not be impacted by the development of a lift, ski trails, or roads. This area would retain its availability for future wilderness consideration and opportunities for semi-primitive recreation would continue.

Skiers and snowboarders would continue entering the Slushman drainage that is within the Bridger IRA either by skiing out of bounds or hiking up the mountain through private land from Bridger Canyon. It is also possible to obtain access through NFS lands; the most common areas are Brackett and Middle Cottonwood drainages.

4.7.4 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 4

In Alternative 4, the proposed ski area expansion to the south of the existing SUP would directly affect the Bridger IRA just like Alternative 2. The proposed new SUP boundary would encompass about 101 acres of the IRA in the Slushman Drainage. A portion of the S-1 chairlift plus portions of ski trails 1S, 2S, and 3S would be within the IRA, resulting in vegetation removal of approximately 1.4 acres and grading of 0.7 acres. Since the trails would be located on open meadows and rock outcroppings, no significant amount of tree cover would be removed to develop this area.

A discussion of impacts to the six wilderness attributes of the undeveloped IRA lands adjacent to the Bridger Bowl SUP is given in Alternative 2.

4.7.5 FOREST PLAN CONSISTENCY

Construction of ski area facilities such as lifts and ski trails are consistent with MA 2 direction. The Bridger IRA within and adjacent to the proposed project area was assigned MA 2. The Forest Plan provides no general direction for roadless areas; the direction comes from the management areas within which these lands are allocated (Forest Plan Annual Monitoring Report, 1992. Item 14, p. 56). MA 2 consists of those portions of Bridger Bowl under Special Use Permit, as well as National Forest System lands north and south of the existing permitted area. The MA includes existing ski trails, lift facilities, and lodges, as well as areas that have potential for development or expansion of facilities to meet increasing demand for downhill skiing.

4.8 AIR QUALITY

4.8.1 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 1

Chapter 3 indicates that although no specific air quality information exists for Bridger Bowl, the air quality conditions in the vicinity of Bridger Bowl are good with low ambient concentrations of pollutants due to limited development and excellent wind dispersion. Pollutant levels are well below state and federal air quality standards. Under Alternative 1, no significant change in the existing air quality would be expected to occur.

Under Alternative 1, skier use at Bridger Bowl could increase slightly. As a result, vehicular traffic to and from Bridger Bowl may also increase. In addition, ongoing residential development, associated wood burning, and vehicle traffic would increase emission levels around the Bridger Bowl base area. However, these impacts would be negligible, and therefore no significant impacts to air quality at Bridger Bowl are anticipated with selection of Alternative 1.

4.8.2 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 2

With selection and implementation of Alternative 2, pollutants are expected to remain well below Montana and NAAQS. No individual sources of emissions requiring an air quality permit from the MDEQ (ARM 16.8.1102) are proposed. The MDEQ advises that the minor source baseline data for Bridger Bowl has not been triggered; hence an increment consumption or PSD analysis is not required for the relatively minor Bridger Bowl emission sources.

Short-term air quality effects from the expansion construction activities include increased vehicle and equipment emissions, and increased suspended particulates from construction equipment and other site preparation activities. The clearing of ski trails, road construction, and base area facility building would have minimum impact on air quality--primarily dust and equipment emissions. The burning of slash piles would pose the greatest short-term air quality impact. Most of the pile burning would take place during early to late fall and would be in compliance with the Montana Smoke Management Memorandum of Agreement (Montana DSL, 1988). The SIS smoke impact spreadsheet (Air Sciences, 2003) was used to estimate $PM_{2.5}$ emissions from the 51.4 acres of ski runs in the SF Brackett Creek which would be cleared without grading. For this procedure, the whole tree would be yarded to landings near the Limestone Chalet area, where the limbs would be removed, the boles hauled away, and the slash burned.

The SIS model for slash burning estimated that about an acre of slash material would be burned total, and the slash pile would average 15' in depth in moderate wind dispersion conditions. The model outputs included about 369 tons of mass consumed, and 2.49 tons of $PM_{2.5}$ emissions (using the CONSUME pile burn part of the SIS model). The modeled $PM_{2.5}$ concentrations (using the CALPUFF part of the SIS model) were estimated at 57.9 uq/m3 of $PM_{2.5}$ at 0.1 miles from the piles decreasing to 1.9 uq/m3 of $PM_{2.5}$ at the Bridger Bowl base area about 1.3 miles from the Limestone Chalet. The $PM_{2.5}$ concentrations would

comply with the NAAQS $PM_{2.5}$ 24 hour standard (65 ug/m3) at the ambient point of concern (Bridger Bowl base area). The coarse particulates would increase during these short-term burning events, but would rapidly decrease as fuels are consumed. Slash piles tend to ignite rapidly and burn quickly so the smoke emissions dissipate quickly. Because most of the vegetation that is cleared during project implementation would be sold as merchantable timber or be lopped and scattered, it is expected that there would be relatively small amounts of slash burned for Alternative 2. Therefore, any slash burned would not cause any long-term air quality impacts.

Increased vehicle traffic would occur at Bridger Bowl with associated increases in tailpipe emissions, primarily hydrocarbon and nitrogen oxides. Increased vehicle emission impacts would occur from Bozeman to Bridger Bowl, primarily within an hour of lift opening and closing. With the exception of pre-season and post-season maintenance operations and relatively light summer use, traffic would be over snow covered or wet road surfaces that would limit or eliminate road source particulates. However, during summer months, road use at the base area and Deer Park Chalet would generate some dust and suspended particulates.

Peak weekend 1-hour vehicle emissions in the Bridger Bowl base area for Alternative 2 were estimated using AP-42 (EPA, 1998) emission factors for light duty gasoline powered vehicles (autos, pickups, and vans). As shown in Table 4.8-1, the Alternative 1 peak weekend hour would increase to an estimated 1277 vehicles/ hour in Alternative 2. Hydrocarbon emissions during the 2010 peak weekend hour would increase from an estimated 345 grams/hr in Alternative 1 to 804 grams/hr in Alternative 2. Carbon monoxide would increase from an estimated 5,080 grams/hr in Alternative 1 to 11,900 grams/hr in Alternative 2. Nitrogen oxides would increase from an estimated 476 grams/hr in Alternative 1 to 1117 grams/hr in Alternative 2.

Table 4.8-1
Peak Weekend Hour Vehicle Emissions

Parameter	Alt. 1	Alt. 2
Vehicles per hour	545	1,277
Hydrocarbons (g/hr)	345	804
Carbon Monoxide (g/hr)	5,080	11,900
Nitrogen Dioxide (g/hr)	476	1,117

Emissions were slightly overestimated by assuming weekend peak hour emissions would occur for an 8 hour day during a 120 day ski season, therefore total emissions would be 0.85 tons of hydrocarbons, 12.6 tons of carbon monoxide, and 5.4 tons of nitrous oxides which if combined into a stationary source of 18.9 tons/year would be too low to require an air quality permit from the Montana DEQ (ARM 16.8.1102). Since these numbers meet the MAAQS and NAAQS, no significant impacts to air quality would be expected from current or potential vehicular traffic due the effects of drainage winds on the local airflow.

Some increase in the use of wood stoves and fireplaces would occur as Bridger Bowl base area development expands (Bridger Pines). Increased residential wood burning from houses and rental units would increase particulate matter, and to a lesser degree carbon monoxide, nitrogen oxides, and organic compound emissions. New fireplaces and wood stoves must comply with the 40 CFR 60.352 standards for particulate matter. Only certified stoves, furnaces, or catalytic converters that comply with the standards would be installed.

Wood burning particulate emissions in the Bridger Bowl base area were estimated with data from the State of Montana (1991) using emission rates of 3.26 grams/hr for wood burning stoves and 7.37 grams/hr for fireplaces. Alternative emissions were estimated assuming 153 wood burning stoves and 5 fireplaces. Assuming all stoves and fireplaces operated for 24 hour/day for a 120 day season total particulate emissions would be 1.70 tons for Alternative 2, a 22 percent increase. These emissions would be spread over a 120 day period and would be expected to be well below MAAQS and NAAQS standards.

4.8.3 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 3

Air quality effects of Alternative 3 would be slightly less than Alternative 2 in that the proposed development in Slushman Creek drainage would not occur. Under Alternative 2, no exceedances of the MAAQS or NAAQS were identified, therefore, Alternative 3 would also result in no exceedances of the MAAQS or NAAQS.

4.8.4 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 4

Air quality effects of Alternative 4 would be slightly less than Alternative 2 because the proposed development in the South Fork Brackett Creek drainage (Bradley Meadow area) would not occur. Under Alternative 2, no exceedances of the MAAQS or NAAQS were identified; therefore, Alternative 4 would also result in no exceedances of the MAAQS or NAAQS.

4.8.5 FOREST PLAN CONSISTENCY

The Forest would comply with the Montana Department of Environmental Quality in the SIP. The requirements of the SIP and Montana Smoke Management Memorandum of Agreement would be met (Forest Plan II-23).

4.9 CULTURAL RESOURCES

4.9.1 DIRECT AND INDIRECT EFFECTS

As there are no recorded cultural sites within the project area, there would be no direct, indirect or cumulative effects to cultural resources under any of the alternatives.

In their 1999 comment letter, the Confederated Salish and Kootenai Tribes of the Flathead Nation indicated that the project would have no impact on their cultural resources:

> "As requested we have conducted a review of our cultural resource records for the [Bridger Bowl Master Development Plan] project location. Currently, we have no information which suggests that this action would impact significant cultural, historical or spiritual-use sites." (White, 1999)

All alternatives are consistent with Forest Plan standards for cultural resources (p. II-17). In accordance with Federal Laws and Regulations, the FS has fulfilled its obligation relating to the Historic Preservation Act of 1966 (as amended) and the Archaeological Resource Protection Act of 1979.

4.9.2 FOREST PLAN CONSISTENCY

As directed by the Forest Plan, a cultural resource inventory was conducted for the Study Area. Because no cultural resources were identified within this area, there would be no effects as a result of implementation of this proposal. The project would be consistent with the Forest Plan standards for cultural resources.

4.10 RECREATION

The primary focus of this proposal is to improve the overall recreation experience at Bridger Bowl for current users and to maintain high quality conditions for anticipated future users. Each of the action alternatives would provide additional developed winter recreation opportunities within and adjacent to the SUP area, with increased access to the ridge and expansion to the north and/or south. They also propose additional lift and trail construction within the expansion areas. Completion of the new day lodge and construction of the Limestone Chalet, while not included in this proposal, would also increase guest service space and help improve the quality of the experience as well.

4.10.1 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 1

Alpine Skiing

Alternative 1 would represent no change in ski area operations at Bridger Bowl. With selection of Alternative 1, there would be no expansion of the SUP boundary to the north or the south of the existing ski area and no change in the Management Area prescriptions for lands in the vicinity of Bridger Bowl. With selection of Alternative 1, there would be no new lift construction or trail development. Existing conditions would persist, including circulation and distribution problems relative to the Alpine and Bridger lifts, multiple ability levels skiing together on novice trails, and perceived crowding on mid-mountain trails (especially on days with delayed opening of the ridge). Bridger Bowl skiers would also continue to experience long lift lines on weekends and holidays. With selection and implementation of Alternative 1, Bridger Bowl would be unable to meet the expectations and demands of today's skier market with no technological upgrades and no expansion of terrain.

Skier visitation at Bridger Bowl would continue to be directly related to population growth in the local area; however, it would also be inhibited by lack of capital improvements. As a result, the anticipated increase in annual skier visitation to Bridger Bowl would be modest and is not anticipated to accommodate regional population growth of 1.5 percent per year. Without facility upgrades or terrain expansions, Bridger Bowl would have a difficult time competing in the marketplace. Alternative 1 would indirectly result in increased visitation at other ski areas in the state, as limited capacity at the Bridger Bowl would cause both local and regional skiers to seek alternative locations.

The economic viability of a ski area is directly related to the quality of the skiing experience. The quality of the experience is relative to the level of crowding on the slopes, the extent of lift lines, and the price of various skier services. As the population growth continues in and around Gallatin County, the ski area would experience a reduction in the quality of the experience as well as a decrease in its economic viability. As a result, more skiers would travel to other resorts in the area, which would further reduce the viability of the resort as a result of declining skier visitation.

Other Recreation

Under Alternative 1, unauthorized access to NFS lands through the permit area and adjacent private lands would continue, as would concerns regarding avalanche hazards and accessibility for search and rescue teams the Slushman drainage and Bradley Meadows. Alternative 1 would represent no change to other existing recreation opportunities in the area, such as the Bohart Ranch Nordic skiing operation, dispersed backcountry skiing, snowmobiling, and various summer activities.

4.10.2 DIRECT AND INDIRECT EFFECTS COMMON TO ALL ACTION ALTERNATIVES

Under all action alternatives, Bridger Bowl proposes to remove the existing Alpine Lift and construct two new lifts (A-1 and A-2) in alternate alignments to replace it. The A-1 Lift would be constructed from 6,520 feet to 7,380 feet in elevation and have a length of approx 3,700 feet, with a design hourly capacity of 1,800 skiers. This lift would service the existing intermediate and advanced terrain from Limestone Flats to the North Bowl.

The A-2 Lift would be constructed from 6,550 to 7,380 feet in elevation and have a length of approximately 3,800 feet, with a design hourly capacity of 1,800 skiers. This lift would improve service to the existing terrain on the north side of the existing Alpine Lift. The two new lifts would improve the separation of ability levels and increase the number of repeat skiers in the Alpine terrain area, while helping to maintain low skier densities.

Bridger Bowl proposes to upgrade the Bridger Lift in its existing alignment to a fixed grip triple that has a design capacity of 1,800 skiers. Once the Bridger Lift is modified as proposed, the Deer Park Lift would experience crowding in the unload area at the top terminal. As a result, Bridger Bowl proposes to shorten the top terminal of this lift down to 7,380 feet in elevation. They would also replace the bottom terminal with a more modern, more compact hydraulic system, thereby improving skier distribution in this area, make the lift better suited for early season operations, improve access from terrain in the Pierre's Knob pod to the Deer Park Chalet, better accommodate race training, and improve access to groomed trails for more guests.

Connected Actions

Modifications to the existing Virginia City Lift and the proposed Limestone Chalet are projects that would occur on adjacent private lands and are therefore not governed by the Forest Service. As connected actions, however, the effects of these project elements must be disclosed in this proposal. These two project elements are common to all action alternatives.

Bridger Bowl proposes to relocate the bottom tension terminal of the Virginia City Lift uphill about 200 feet to alleviate congestion on the south side of the day lodge. Additionally, the Limestone Chalet would be constructed on private lands slightly uphill and to the south of the bottom terminal of the proposed N-1 Lift. The addition of this facility would provide additional on-mountain skier services and help reduce some of the

congestion in the base area. The Limestone Chalet would offer food service, restrooms, a place to warm up, and incidental retail. All proposed facilities would meet ADA[1] requirements under each of the action alternatives. Accordingly, Alternative 2 would represent improved access for physically challenged visitors.

4.10.3 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 2

Alpine Skiing

Alternative 2 would provide additional terrain primarily for intermediate and advanced level skiers. With selection of Alternative 2, the Bridger Bowl SUP boundary would be expanded by approximately 337 acres to the south into the Slushman Drainage and approximately 274 acres to the north into the Bradley Meadows area.

The expansion of the SUP boundary north into Bradley Meadows would include construction of the N-1 Lift from 6,800 feet to 7,880 feet in elevation with an approximate length of 5,082 and a design hourly capacity of 1,800 skiers. This lift would provide access to the eight proposed trails within the N-1 pod and to the proposed P-3 pod. The P-3 Lift would be constructed from 7,860 feet to 8,530 feet in elevation with a length of 1,470 and a design hourly capacity of 300 skiers. It would offer lift access to the north end of the ridge. One new trail associated with the P-3 Lift is proposed for construction under Alternative 2.

The expansion of the SUP boundary to the south into the Slushman Drainage would include construction of the S-1 Lift on the south side of the ridge in the Slushman Drainage from 7,000 feet to 7,900 feet in elevation with a length of 2,330 and an hourly design capacity of 1,800 skiers. This lift would be specifically sited to avoid historic avalanche activity. This lift would provide access to the five proposed trails within the S-1 pod and to the proposed P-2 Lift, most of which would be advanced and expert terrain. Trail S-5 would allow skiers in the S-1 pod to return to the main mountain. The P-2 Lift would offer lift access to the south end of the ridge. Two additional trails would be constructed in conjunction with the P-2 Lift.

Expansion into both the Slushman and Bradley Meadow areas would provide new and varied terrain for existing skiers and allow for expansion to accommodate expected growth. The combination of these two new expansion areas would also provide some unique and distinctive skiing opportunities for intermediate to expert skiers. Consequently, Alternative 2 would likely generate greater visitation and increased economic viability over the long term.

The development of surface lift P-2 would enhance the ability of the ski patrol to control avalanche hazard within the Slushman drainage (i.e., the South ski pod), thereby providing a safer environment for skiers in that area. The incidence of unauthorized backcountry skiing use of the Slushman area would be largely eliminated. Access to the

[1] Americans with Disabilities Act of 1990 (ADA). A copy of the April 18, 1994 draft of the *Snow Facilities Accessibility Recommendations to the U.S. Transportation and Architectural Barriers Compliance Board* is on file at the Ranger District office.

Slushman drainage would be authorized via the ski area under Alternative 2, and Bridger Bowl would be authorized to conduct avalanche hazard reduction missions, thereby reducing the potential threat to public safety caused by unauthorized use of the area. On any given day, lifts P-2 and S-1 and associated trails would be closed to the public until necessary avalanche hazard reduction work has been completed.

Under Alternative 2, growth in skier visitation would correlate more closely with improvements and expansion to the ski area and its facilities. It may also be affected by the development of overnight accommodations on adjacent private land. Bridger Bowl would accomplish the projects identified in this alternative over a period of time based on anticipated skier demand, project cost and the effects on lift ticket prices, and the competitive effects of other ski areas. At full implementation of Alternative 2, the lifts and terrain of the ski area would have a CCC of 6,100. As the SAOT increases under Alternative 2, skier visitation would be expected to increase at a level commensurate with current utilization rates for ski areas of similar size and market orientation. An increase in lift capacity would increase skier density; however, this is balanced by the increase in skiable terrain. As a result, skier densities would be very similar to those described under existing conditions.

Other Recreation

Revisions to the travel management plan proposed as wildlife mitigation for this proposal would prohibit snowmobile use in SF Brackett Creek. No other direct impacts to snowmobiling use would be expected under Alternative 2. With increased alpine and Nordic skiing visitation, the demand for lodging and other winter recreation activities, such as dining and shopping, would also increase on private land in the vicinity of Bridger Bowl and in the community of Bozeman.

Summer Recreation

Summer construction of lifts A-1, A-2, and N-1 and associated alpine trails, could temporarily disturb recreation use of the hiking trail that traverses Bridger Bowl. For short time periods (i.e., during construction) the experience of some hiking, horseback riding, and mountain biking enthusiasts may be diminished and/or interrupted. Immediately following construction of a particular lift or ski trail, the hiking trail would be restored. No long-term impacts to summer recreation opportunities in the area would be anticipated.

4.10.4 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 3

Alpine Skiing

Alternative 3 proposes expansion of the SUP boundary only to the north, including Bradley Meadows. As a result, the N-1 Lift, N trails, P-3 Lift, and P-3 trail as described under Alternative 2 would be constructed. The expansion into Bradley Meadows would provide necessary additional terrain for intermediate skiers, and the P-3 Lift would increase accessibility to the ridge.

Under Alternative 3, Bridger Bowl would not expand its SUP boundary to the south into Slushman Drainage. The S-1 and P-2 lifts and S trails would not be constructed. The proposed new lifts and modifications within the existing area and in the proposed Bradley Meadows expansion area would be installed at higher capacities than under Alternative 2, bringing the lifts and terrain CCC to 5,600. As a result of increased capacity lifts and reduced terrain expansion, skier densities in these areas would be higher than under Alternative 2. This would diminish the skiing/boarding experience as compared to Alternative 2, but it would still represent an improvement over existing conditions.

On a peak day, lift line waits would likely double on the Bridger and Deer Park lifts. Additional skiers and density would be located on the trails associated with Deer Park and proposed A Lifts. Alternative 3 would not fully meet the purpose and need for the proposal, which is to decrease skier density across the mountain and provide a better recreation experience at Bridger Bowl.

Alternative 3 would have additional positive effects to recreation as disclosed under project elements common to all action alternatives with the removal of the Alpine Lift, construction of the A-1 and A-2 lifts, and upgrades to the Bridger and Deer Park lifts within the existing ski area. The Virginia City Lift would be modified to reduce congestion in the base area, and the Limestone Chalet would be constructed, providing additional skier services on the mountain and reducing congestion in the base area.

Overall, visitation growth under Alternative 3 would correlate with improvements and expansion to the ski area. Although it would result in an improvement over existing conditions, Alternative 3 would likely drive less visitation than Alternative 2 over the long term.

Other Recreation

Under Alternative 3, the effects to snowmobiling would be the same as those disclosed under Alternative 2, with use prohibited in SF Brackett Creek. Effects to backcountry skiing would be similar to those disclosed under Alternative 1. Unauthorized access to NFS lands through the permit area and adjacent private lands would continue, as would avalanche safety concerns associated with out-of-bounds skiing in the Slushman drainage.

The effects to summer recreation would be the same as those disclosed under Alternative 2, with minor disruptions during lift and trail construction to the hiking trail that traverses the Bridger Bowl SUP area.

With increased alpine and Nordic skiing visitation, the demand for lodging and other winter recreation activities, such as dining and shopping would also increase on private land in the vicinity of Bridger Bowl and in the community of Bozeman.

4.10.5 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 4

Alpine Skiing

Alternative 4 proposes expansion of the SUP boundary only to the south, including the Slushman Drainage. As a result, the S-1 Lift, S trails, P-2 Lift, and P-2 trails as described under Alternative 2 would be constructed. The expansion into the Slushman Drainage would provide additional advanced and intermediate terrain, and the P-2 Lift would increase accessibility to the ridge.

Under Alternative 4, Bridger Bowl would not expand its SUP boundary to the north into Bradley Meadows. The N-1 and P-3 lifts and N trails would not be constructed. The proposed new lifts and modifications within the existing area and in the proposed Slushman Drainage expansion area would be installed at higher capacities than disclosed under Alternative 2, bringing the lifts and terrain CCC to 5,100. As a result of increased capacity lifts and reduced terrain expansion, skier densities in these areas would be higher than under Alternative 2. Lift line wait times would also increase by approximately 25 percent on the proposed Alpine lifts over Alternative 3. This would diminish the skiing/boarding experience as compared to Alternative 2, but it would still represent an improvement over existing conditions.

The avalanche safety benefits derived from surface lift P-2 would be the same as disclosed in Alternative 2. Similarly, the incidence of unauthorized backcountry skiing access to the Slushman drainage would largely be eliminated as a result of adding this area to Bridger Bowl's SUP. Project elements common to all action alternatives as well as the connected actions disclosed previously would occur under Alternative 4. These project elements include the removal of the Alpine Lift, construction of the A-1 and A-2 lifts, and upgrades to the Bridger and Deer Park lifts within the existing ski area. The Virginia City Lift would be modified to reduce congestion in the base area, and the Limestone Chalet would be constructed, providing additional skier services on the mountain and reducing congestion in the base area.

Overall, visitation growth under Alternative 4 would correlate with improvements and expansion to the ski area. Alternative 4 would likely generate somewhat less visitation over the long-term, as compared to Alternative 2.

Other Recreation

Under Alternative 4, the N-1 and P-3 lifts and their associated trails are not proposed for construction. As a result, short-term lift and alpine ski trail construction related impacts to summer hiking, horseback riding and mountain biking enthusiasts would be less than those disclosed under alternatives 2 and 3. No long-term impacts to hiking opportunities in the area would occur.

With increased alpine and Nordic skiing visitation, the demand for lodging and other winter recreation activities, such as dining and shopping would also increase on private land in the vicinity of Bridger Bowl and in the community of Bozeman.

4.10.6 FOREST PLAN CONSISTENCY

Implementation of alternatives 2 and 3 would require an amendment to the Forest Plan. This would entail:

Changing management area designations in the proposed expansion areas to MA 2, which reflects developed recreation areas/winter sports areas.

A portion of the proposed Slushman skiing pod is located within the Bridger Roadless Area #1543; however, the current Forest Plan has allocated this area to Management Area 2. Accordingly, no amendment to the Forest Plan would be required for development within the Slushman drainage.

All of the alternatives would be consistent with the recreation standards as stated in the Forest Plan.

4.11 VISUAL RESOURCES

Under all action alternatives, impacts to visual resources may occur as a result of tree clearing and the construction of lifts and mountain access roads. A visual simulation was developed for Alternative 2, as viewed from BCR, to illustrate potential visual impacts associated with proposed project components (see Figure 4-5). This simulation depicts the worst-case scenario with implementation of the Proposed Action. At this scale it is difficult to display the scalloping and feathering techniques that would be utilized during construction to imitate the characteristic vegetative patterns of the area.

Travelers on BCR heading north within two miles of the Bridger Bowl access road would notice a change in the landscape. The proposed surface lifts and the ski terrain served by these lifts would not be readily visible due to the vertically oriented rock areas and vegetation openings above the existing ski area openings and clear-cut areas. This lack of visual change resulting from the construction of the surface lift and use of the ski terrain is comparable to the existing surface lift (P-1) and existing ski terrain on the ridge. The existing ridge terrain is not readily visible from BCR or the selected viewpoint. Ski trail openings would be visible below the Bradley Meadows ridge.

All action alternatives propose openings that would be designed to replicate the existing opening pattern of the ski area and surrounding higher terrain, with scalloping and feathering of the trails and making use of existing openings. The degree of impact would depend on how the openings are designed with respect to their shape, edge treatment, and width variability. Construction of lifts and trails would be monitored by Forest Service personnel to ensure the use of practices outlined in The National Forest Landscape Management Handbook 617 for Ski Areas (Volume 2, Chapter 7) and State of Montana and Forest Service Region One Best Management Practices (FSH 2509.22, *Soil and Water Conservation Practices Handbook*) would be followed and the projects would be subordinate to the characteristic landscape.

Base area facilities, both existing and proposed, are located on private lands, which are not governed by Forest Plan standards and guidelines, nor are they required to meet VQOs. However, none of them currently are or would be visible to observers along BCR.

4.11.1 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 1

Under Alternative 1, the proposed project elements discussed for alternatives 2 through 4 would not be constructed. No new ski trails or lifts would be developed or installed. As such, there would be no impacts to or change in the visual quality of the project area under Alternative 1.

4.11.2 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 2

Alternative 2 includes the replacement and modification of lifts within the existing SUP area and development of new lifts and associated trails in both the Slushman and Bradley Meadows areas. Project elements in the Bradley Meadows would likely be more visible to observers along BCR than those proposed in the Slushman area. One element of this

proposal is to amend the Bradley Meadows area from MA 12 to MA 2 with the proposed SUP boundary expansion. As a result, the VQOs assigned to Bradley Meadows would change from *Retention* to *Partial Retention*, which is the designated VQO for the existing Bridger Bowl SUP area.

Proposed lift development and trail clearing in the upper and middle elevation zones would be visible as viewed from BCR (middle ground view). Development in the lower elevation zone would be obscured by topography and vegetation and would not be visible to travelers along BCR. All new lifts and facilities would be required to meet Forest Plan standards and guidelines for visual resources. As such, lift infrastructure would be painted with non-reflective paint.

Proposed clearing within the Slushman area (proposed southern SUP expansion area) would be minimal. The Slushman area is comprised primarily of open meadow with widely scattered individual trees. Clearing would occur to create skiable openings through small tree islands. Sharp lines and shapes uncharacteristic of the surrounding environment would be minimized and broken up where possible by existing openings in the vegetation. Clearings would be designed to replicate natural openings/glades and would not be evident to the casual observer.

Vegetative patterns within the Bradley Meadows area includes large meadows surrounded by dense tree cover. As such, proposed clearing within the Bradley Meadows area would be more evident than clearing discussed within the Slushman area. Trail development within meadows would not involve much clearing and would not be evident to viewers along BCR. However, clearing for proposed *Trails N2, N3* and *N4* would occur in more dense vegetative cover and has the potential to introduce more sharp lines, shapes, and forms uncharacteristic of surrounding vegetative patterns (see Figure 4-5). Proposed *Trails N2, N3* and *N4* would include scalloped and feathered edges, resulting in a softer line between proposed ski trails and existing vegetative cover, in order to reduce the visual dominance of the project elements. Clearing would be visible to observers along BCR; however, it would remain visually subordinate to the surrounding landscape and would be designed to replicate natural openings.

Proposed lift realignment within the existing SUP area would not introduce any new form or lines, as compared to existing conditions. Openings for skiing in the rocky cliff area, upper elevation zone, would be similar to the existing conditions, with very minor tree removal. These openings would be barely visually discernable from BCR.

Overall, implementation of Alternative 2 would meet the prescribed VQO of *Partial Retention*. As stated previously, expanding the SUP boundary to the north (Bradley Meadows) would modify the management area prescription from MA 12 to MA 2. As such, the prescribed VQO for the area would be modified from *Retention* to *Partial Retention*.

4.11.3 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 3

Alternative 3 modifies the Proposed Action by not proposing expansion into the Slushman Drainage. It includes the construction of four new lifts – one surface lift (P-3), and three chairlifts (A-1, A-2, and N-1) for a total of 11 lifts. The replacement and/or modification of two existing lifts (Deer Park and Bridger) would be as described under Alternative 2. Alternative 3 also includes the development of nine new trails in the Bradley Meadows area. This would expand the developed trail network by approximately 52 acres for a total of 459 acres. Lastly, Alternative 3 would increase the Bridger Bowl road network by 1.1 mile to 17.1 miles total.

Overall, implementation of Alternative 3 would meet the prescribed VQO of *Partial Retention* (see Figure 4-5). Expanding the SUP boundary into Bradley Meadows would modify the management area prescription from MA 12 to MA 2. As such, the prescribed VQO for this area would be modified from *Retention* to *Partial Retention* and would be consistent with Forest Plan direction for MA 2.

4.11.4 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 4

Alternative 4 modifies the Proposed Action by not proposing expansion into the Bradley Meadows area. Four new lifts would be constructed under Alternative 4; one surface lift (P-2), and three chairlifts (A-1, A-2, and S-1). The replacement and/or modification of two existing lifts (Deer Park and Bridger) would be as described under Alternative 2. Seven new trails would be constructed in the Slushman Drainage area, which would expand the developed trail network by approximately 45 acres. Lastly, Alternative 4 would increase its road network by 1.1 miles to 17.1 miles total.

Implementation of Alternative 4 would meet the prescribed VQO of *Partial Retention*. With no proposed project elements in the Bradley Meadows area, which is more visible from BCR than Slushman, the impacts to visual resources as a result of Alternative 4 would be greatly reduced from those disclosed under alternatives 2 and 3.

4.11.5 FOREST PLAN CONSISTENCY

Implementation of alternatives 2 and 3 would require an amendment to the Forest Plan. This would entail:

Changing the VQO currently assigned to the Bradley Meadows area from *Retention* to *Partial Retention*, which is the VQO that applies to MA 2.

As a result, the proposal would be consistent with Forest Plan Direction for visual quality.

Figure 4-5: Visual Simulation

4.12 SOCIO-ECONOMICS

Direct, indirect, and induced socio-economic impacts to the study area are expected to increase under all alternatives.

Primary (direct) impacts of the action alternatives include direct payments for goods and services (labor) in connection with the project during construction, as well as long-term operations. Indirect impacts would result from expenditures by project suppliers for machinery and materials such as piping, pumps, accounting services, etc. Induced impacts would generally occur in the wholesale and retail trade and personal services sectors of the economy by households affected by the project. The socio-economic impacts from indirect and induced spending are often referred to as "ripple" or "multiplier" effects, as increased employment income is spread through the economy.

Table 4.12-1 represents long-term quantitative differences between the alternatives addressed in this report. Development under alternatives 2, 3 and 4 would occur over the course of three phases and approximately 10-15 years, pending changes to the marketplace and development of private lands around the ski area for residential use. Alternatives 3 and 4 provide for fewer lifts and trails than Alternative 2, to address specific environmental concerns. Expected social and economic impacts by alternative are generally described below.

Table 4.12-1
Summary of Estimated Social and Economic Effects

	Base	Alt. 1 Long-term[a]	Alt. 2 Long-term[b]	Alt. 3 Long-term[b]	Alt. 4 Long-term[b]
Annual skier visits[c]	167,000	183,000	321,000	300,000	297,000
Development costs	$0	$0	$12,000,000	$11,500,000	$11,000,000
Gallatin County population[d]	64,831	74,310	74,860	74,820	74,820
Housing - total units[e]	16,283	18,393	18,513	18,503	18,503
Employment FTE jobs					
Construction Direct/indirect[f]	0	0	13	13	12
Ski area ops direct	87	87	152	142	142
Indirect[g]	164	164	286	267	267
Fiscal considerations					
USFS fees	$30,005	$30,005	increase	increase	increase
Fed unempl/soc sec	$134,637	$134,637	$180,000	$168,000	$168,000
State unemployment	$42,289	$42,289	$44,000	$41,000	$41,000
Property taxes	$64,178	$64,178	increase	increase	increase

Source: Bridger Bowl; US Census Bureau; Woods and Poole Economics, Inc.; US Department of Commerce, Regional Employment Multipliers - 1989; US Chamber of Commerce; Sno.engineering, Inc.

In the table above, it is important to note that the effects disclosed are the result of no action or implementation of the action alternatives only; they do not reflect changes in social structure or the economy that may result from sources unrelated to Bridger Bowl. Additionally, the long-term effects disclosed for alternatives 2-4 are contingent upon several factors, including changes in the marketplace and development of private lands near the ski area. Effects represent an additional increase in skier capacity of 127 percent over the long term and resulting increases in visitation and unemployment.

Environmental Justice

None of the alternatives are anticipated to have any significant impact on minority or low-income populations. The potential environmental impacts from implementation of the alternatives would not directly affect the low-income populations that were identified in the city of Bozeman. Potential indirect impacts from implementation of the alternatives would not disproportionately impact these populations. No minority populations were identified within the social and economic analysis area. Furthermore, Bridger Bowl does not discriminate in their hiring practices; therefore, low-income and minority populations would have an equal opportunity to obtain new jobs created by implementation of the alternatives.

No impacts to American Indian cultural resources have been identified under any of the alternatives. For a discussion of Cultural Resource issues related to cultural properties of significance to American Indians, refer to Section 4.9 – Cultural Resources.

The closure of Forest Development Road 3200 during Bridger Bowl's operational season is an existing condition under Alternative 1. This closure is unrelated to the Bridger Bowl Master Plan Proposal, and currently restricts access to some forms of dispersed recreation during the winter under all alternatives. For a complete discussion of dispersed recreation impacts, refer to Section 4.10 – Recreation.

4.12.1 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 1

In the short-term (one to three years), Alternative 1 represents no significant change to the social and economic climate of the Bozeman and Gallatin Valley areas. Over the long-term (five to ten years), the lack of adequate terrain, lifts, base area facilities, and reliable snowmaking capabilities would likely lead to declines in the ski area's market share, the quality of the ski experience relative to other Montana offerings, and the revenues generated by the ski area.

Alternative 1 represents the potential for long-term negative impacts to the socio-economic climate of the Bozeman area, including minor reductions in the average direct and indirect income and seasonal employment, stagnant or reduced Forest Service fees, and reductions in federal, state, and local revenues and fees paid. Stagnation at the ski area would result in a reduction in the recreation experience, which would directly result in the decreasing economic viability of the ski area.

Reductions in the ski area's ability to adequately serve the needs of its growing local customer base may reduce the appeal of the ski area, which is often cited as a major

recreational opportunity contributing to the quality of life in the area. Population increases are projected to continue for the project area, and demand for skier services is expected to grow accordingly, particularly during weekend and holiday periods. Without enhancements to the current facilities, Bridger Bowl would be unable to adequately serve its local customer base during its typical heavy-use periods, and would not be positioned to grow mid-week destination visitor business, as lifts, terrain, and guest services capabilities would lag behind other Montana and western resorts. Inadequate facilities to handle growing demand could lead to erosion of the local season pass. Lost market share from Bridger Bowl would likely be absorbed by other Montana, Wyoming, or Idaho ski resorts. As mentioned in the Recreation Section (Section 4.10), national skier visit totals have increased by approximately 5.5 percent and Montana skier visit totals have increased by approximately ten percent over the past ten years, as the state's promotion division has drawn attention to Montana ski areas for destination visitors, and other state ski areas have invested in improvements.

4.12.2 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 2

The improvements proposed under Alternative 2 would result in positive short-term direct and indirect impacts to employment and income in the project areas, as the result of expenditures by project suppliers and subcontractors.

Long-term employment impacts would generally be gradual in response to the development of new lifts and facilities at Bridger Bowl and increasing visitation. By the year 2013, it is expected that employment at Bridger Bowl would increase by approximately 65 full-time equivalent (FTE) jobs, with proportional increases to employment tax payments and indirect jobs. In the short-term (one to three years), it is expected that most new jobs would be absorbed by the existing labor force. Over the long-term (five to ten years), additional employment generated by the ski area may have a modest impact on population and housing by attracting new employees from outside of the area; however, projected growth rates unrelated to ski area expansion suggest that the majority of new ski area related jobs would most likely be absorbed by the projected local labor force.

Replacing older and less efficient lifts, and adding more terrain for intermediate and advanced skiers would create greater on-hill capacity for the ski area. In the long-term, increased capacity would allow Bridger Bowl to effectively serve its growing local market, as well as make it a more attractive option for Montana's growing destination skier market.

The parking expansion and base area facility improvements would be important complements to increased on-hill capacity and necessary to accommodate the demand already created by the Bozeman area's population growth. Modern amenities and convenience in the base area facilities are also important components for attracting and serving destination skiers. Population growth would be anticipated to continue as projected in Table 3.12-1 regardless of the proposed expansion at Bridger Bowl. Enhancing the overall recreation experience would serve to improve the economic viability of the resort in the long term.

4.12.3 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 3

The improvements proposed under Alternative 3 would result in positive short-term direct and indirect impacts to employment and income in the project areas similar to those under Alternative 2, as the result of expenditures by project suppliers and subcontractors. Short-term construction related impacts would be slightly less than in Alternative 2, since the lift and trail network serving the Slushman drainage would not be developed. By the year 2013, it is expected that employment at Bridger Bowl would increase by approximately 55 full-time equivalent (FTE) jobs, with proportional increases in employment tax payments and indirect jobs.

In the long-term, the comparative difference in impacts between alternatives 2 and 3 would be modest. The absence of the Slushman drainage lift and trail network would result in somewhat higher skier densities within the existing ski area and the north skiing pod, and likely would result in a smaller increase in skier visitation. Otherwise, Alternative 3 would produce the same benefits in ski terrain and skier services as Alternative 2. In the long-term, no significant difference in impacts would be expected between alternatives 2 and 3. Alternative 3 would result in creation of fewer acres of intermediate to advanced skiing, which could have a slight negative effect on skier visitation, although it would be an improvement over the existing condition. Alternative 3 would otherwise produce all of the same benefits in ski terrain and skier services as Alternative 2.

4.12.4 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 4

The improvements proposed under Alternative 4 would result in positive short-term direct and indirect impacts to employment and income in the project area similar to those described for alternatives 2 and 3, as the result of expenditures by project suppliers and subcontractors. Short-term construction related impacts would be slightly less than in Alternative 2, since the lift and trail network serving the north skiing pod would not be developed. By the year 2010, it is expected that employment at Bridger Bowl would increase by approximately 55 full-time equivalent (FTE) jobs, with proportional increases employment tax payments and indirect jobs.

In the long-term, the comparative difference in impacts between alternatives 2 and 4 would be modest. The absence of the lift and trail network in Bradley Meadow would result in somewhat higher skier densities within the existing ski area and the Slushman skiing pod. This would also likely result in a smaller increase in skier visitation. Otherwise, Alternative 4 would produce the same benefits in ski terrain and skier services as Alternative 2.

4.12.5 FOREST PLAN CONSISTENCY

No Forest Plan standards or guidelines have been determined for social and economic resources, either forest-wide or for MA 2.

4.13 TRANSPORTATION

4.13.1 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 1

Under Alternative 1, the existing level of skier use is expected to continue to grow with respect to population growth in the area.

Growth Rates

Population projections were made for the greater Bozeman area in the *Greater Bozeman Area Transportation Plan - 2001 Update.* A growth rate of 1.6 percent was determined from 1997-2002. Discussions with the Gallatin County Planning Office indicate that growth rates for Bridger Canyon have been significantly less than for the remainder of the county. This is due to the extremely exclusive nature of the zoning restrictions which apply to the Bridger Canyon Zoning District. Based on this information, a growth rate of 1.0 percent per year was estimated for projecting future traffic volumes on the roads in Bridger Canyon.

Traffic Volumes on Bridger Canyon Road

The existing daily traffic volumes for 2002 were factored up by 1.0 percent annual growth rate to project future volumes for the year 2010. These future projections correspond to the time frame for at least partial implementation of the action alternatives for Bridger Bowl. This analysis is based on the peak hour traffic volumes resulting from ski area traffic. Projected peak hour traffic volumes were calculated for the year 2010 daily volumes on the roads in the Bridger Canyon area. Projected peak hour traffic volumes for weekends and week days are shown below.

Table 4.13-1
Alternative 1 Projected Peak Hour Traffic Volumes in 2010 (vehicles/hour)

Mile Post Along BCR	Total Traffic on Peak Week Day (am/pm)	Total Traffic on Peak Weekend Day (am/pm)
MP-8[a]	489	708
MP-15	370	607
MP-17	64	66

[a] The 2002 data utilizes MP -8, 15, and 17. The 1999 EIS used road segment names. A determination was made to use mile markers to provide the best comparison of data.

Future Level of Service

A future LOS analysis was performed on BCR segments and on the intersections in the area to determine the impacts of the No Action Alternative for Bridger Bowl. The LOS analysis was performed in accordance with the methods outlined in the Transportation Research Board's *Highway Capacity Manual, Special Report 209.*

The LOS analysis for Alternative 1 was performed using the projected year 2010 morning and evening peak hour traffic volumes. The analysis was performed for peak hours based on both weekend and week day traffic conditions. These volumes for Alternative 1 represent future traffic conditions, with no change to the current operations at Bridger Bowl. The LOS analysis for this alternative does not include any additional development on adjacent private lands. The peak hours used in the analysis correlate to the peak hours of traffic generation at the ski area. The results of the LOS analysis for the road segments and the intersection LOS analyses for Alternative 1 are shown in the following tables.

Table 4.13-2
Alternative 1 Future Road Segment Level of Service Analysis

Segment of BCR	Year 2010 Level of Service	
	Week Day (a.m./p.m.)	Weekend Day (a.m./p.m.)
Kelly Canyon Rd. to Jackson Creek Rd.	B/C	C/C
Jackson Creek Rd. to Bridger Bowl Access Rd.	B/C	C/C

Source: Robert Peccia and Associates, Inc.

The results of the road segment Level of Service analysis indicate that the BCR functions at an acceptable LOS B or C on week days under the No Action Alternative for Bridger Bowl. On weekend days this road operates at an acceptable LOS C, with the exception of Segment 1, which degrades to a LOS D during the evening peak hour.

Table 4.13-3
Alternative 1 Future Intersection Level of Service Analysis

Intersection	Year 2010 Level of Service	
	Week Day (a.m./p.m.)	Weekend Day (a.m./p.m.)
BCR & Kelly Canyon Rd.	A/A	A/A
BCR & Bridger Bowl Access Rd.	A/A	A/A
BCR & Jackson Creek Rd.	A/A	A/A

Source: Robert Peccia and Associates, Inc.

The intersection analysis reveals that under the Alternative 1, the four main intersections along BCR are expected to function at an acceptable LOS A. On weekend days when Bridger Bowl is experiencing design skier activity levels, a LOS D results for eastbound left-turning movements at the intersection of BCR with Griffin Drive and North Rouse Avenue during the evening peak hour in the year 2010. The intersection of Griffin Drive with North Seventh Avenue is projected to function at an acceptable LOS A or B under Alternative 1. The conclusion is that BCR would be able to accommodate, with a desirable level of service, background and ski area traffic under Alternative 1.

4.13.2 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVES 2, 3, AND 4

Implementation of alternatives 2-4 is projected to result in a guest services CCC of 5,400 at Bridger Bowl, as limited by base area facilities and infrastructure.

Background Traffic Volumes

The annual growth rates and future projections of traffic volume background levels for alternatives 2-4 in the year 2010 are the same as those estimated for Alternative 1. Future peak hour traffic volumes generated by Bridger Bowl under alternatives 2-4 for the year 2010 were calculated based on the ratio of expected design day skier visits compared to Alternative 1. These future projections correspond to full implementation of proposed project elements under alternatives 2 through 4.

Future ski area traffic volumes were also estimated with the addition of development on adjacent private lands for residences and lodging, as required by the Bridger Canyon Zoning Regulations. It is assumed that a number of the skier visitors would come from guests staying at the adjacent private development; this development would further reduce traffic flows along BCR, as those skiers would reside near the mountain and not commute from Bozeman during peak hours.

Table 4.13-4
Projected Peak Hour Traffic Volumes in 2010
under the Action Alternatives (vph)

Mile Post Along BCR	Total Traffic on Peak Week Day	Total Traffic on Peak Weekend Day
MP-8	864	1,390
MP-15	764	1,325
MP-17	72	81

Future Level of Service

A future LOS analysis was performed on two segments of BCR and three intersections in the area to determine the impacts of the proposed expansion of Bridger Bowl under alternatives 2-4. This analysis includes increased ski area traffic levels as a result of the proposed ski area expansion. The LOS analysis was performed using the projected year 2010 morning and evening peak hour traffic volumes for alternatives 2-4, including both background and ski area traffic.

The peak hours used in the analysis correlate to the peak hours of traffic generation at the ski area. The results of the LOS analysis for the road segments and the intersection analyses for alternatives 2-4 are shown in the tables below.

Table 4.13-5
Alternatives 2, 3, and 4 Future Road Segment LOS Analysis

Segment of BCR	Year 2010 Level of Service	
	Week Day (a.m./p.m.)	Weekend Day (a.m./p.m.)
Kelly Canyon Rd. to Jackson Creek Rd.	D/D	E/E
Jackson Creek Rd. to Bridger Bowl Access Rd.	C/D	E/E

The road segment Level of Service analysis indicates that under proposed expansion alternatives 2-4, the additional traffic generated by the ski area results in increased traffic volumes on BCR. Service levels on BCR for the year 2010 are at LOS C and D for week day peak hours, degrading to LOS D and E during peak hours on the weekend.

Table 4.13-6
Alternatives 2, 3, and 4 Future Intersection LOS Analysis

Intersection	Year 2010 Level of Service (AM/PM Peak Hour)	
	Week Day	Weekend Day
BCR & Bridger Bowl Access Rd.	A/A	A/A
BCR & Jackson Creek Rd.	A/A	A/A1
BCR & Kelly Canyon Rd.	A/A	A/A2

The intersection analysis reveals that under alternatives 2-4, the four main intersections along BCR would be expected to function at an acceptable LOS A or B during week day peak hours; although on the Griffin Drive approaches, eastbound left-turns and westbound turns would experience LOS D and E conditions during week day evening peak hours. Three of the four intersections would continue to operate at LOS A on weekend days although the Jackson Creek and Kelly Canyon Road approaches would experience LOS D or E during weekend evening peak hours in the year 2010.

Traffic Safety

The LOS analysis presented in Chapter 3 shows that the road segments analyzed along BCR currently have LOS grades of A to C, indicating that they are capable of operating with little traffic congestion and vehicle delay. The implementation of alternatives 2-4 would result in increased traffic volumes on BCR, and the LOS grades along BCR would be reduced to C for week day morning peak hours, demonstrating that the road systems are adequate for handling the proposed amount of traffic volume. However, the grades are reduced to D and E for week day evening peak hours and weekend peak hours, indicating that the road system is considered borderline or inadequate in handling the amount of proposed traffic volume.

It is anticipated that the selection of alternatives 2-4 would produce peak hour traffic volumes along BCR that the road system may be unable to adequately support. From 8:30-9:30 am and 4:00-5:00 pm, the road would potentially have an unacceptable level of traffic. However, throughout the remainder of the day, BCR could accommodate projected traffic as a result of the implementation of one of the action alternatives. The increased traffic volume would strain the ability of Gallatin County to adequately maintain the road at acceptable conditions. As a result, vehicle accidents would be expected to increase proportionally to the growth in traffic volume.

Parking

Although parking would be constructed on adjacent private lands, alternatives 2-4 account for expansion of the parking facilities to meet the design capacity as stipulated by the Bridger Canyon Zoning Ordinance for parking on private lands adjacent to the existing parking area.

The existing transit systems in place are currently underutilized. With greater incentive for people to ride the shuttle buses provided by the resort (for locals in town and guests staying at nearby hotels), the demand for parking will not be increase in order to provide skiing for those visitors choosing the shuttle service. With increasing demand for the local bus service, Bridger Bowl would likely increase the transit supply.

4.13.3 FORESTPLAN CONSISTENCY

No Forest Plan standards or guidelines have been outlined for traffic, transportation, and parking either forest-wide or for MA 2. However, under direction for facilities on NFS lands, certain standards apply to transportation on roads and trails on NFS lands. The proposal is consistent with this direction.

4.14 INFRASTRUCTURE AND UTILITIES

Effects to infrastructure and utilities are primarily related to public safety, demand/consumption, efficiency, and reliability. Domestic water effects include availability and quality of potable water for consumption at day lodges and chalets. Potential effects to electrical distribution are primarily related to availability, reliability, and auxiliary power. Fuel storage is typically measured by safety and efficiency. Mountain access network effects are primarily associated with lift construction and maintenance access. In this analysis, the action alternatives would increase the guest services CCC to approximately 6,200 skiers with construction of the Limestone Chalet.

4.14.1 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 1

Domestic Water

Selection of Alternative 1 would result in no change to the existing conditions at the resort. No change would be anticipated in the amount of domestic water utilized by Bridger Bowl. No changes would be made to the existing wells, pumps, or storage basins.

Wastewater

As stated previously, Alternative 1 would result in no change to the existing conditions of the resort. Operations and maintenance would continue as they do currently. The recently upgraded wastewater treatment system is capable of accommodating 5,400 skiers per day and would serve the Jim Bridger Lodge, the Ski Patrol building, the Deer Park Chalet, and the new day lodge upon its completion.

Power

Selection of Alternative 1 would equate to no changes in the existing operations of the resort. There would be no increase in demand for electricity, as no new lifts or facilities would be constructed. Electric power utilization rates at Bridger Bowl would be anticipated to remain fairly constant as a function of number of operating days per season.

Fuel Storage

Bridger Bowl has adequate fuel supply and storage to accommodate its needs under the existing conditions. Selection of Alternative 1 would maintain ski area operations as they currently are; therefore, there would be no change anticipated with respect to fuel supply or storage at Bridger Bowl.

Mountain Access Roads

The existing mountain access road system provides access to the tops of the Alpine, Bridger, and Pierre's Knob lifts. Selection of Alternative 1 would maintain existing

conditions, and no new lifts or trails would be constructed. As a result, the existing roads would remain adequate to accommodate summer lift maintenance needs.

4.14.2 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 2

Domestic Water

Selection of Alternative 2 would result in an increase in the resort's guest services CCC to 6,200 guests. Construction of the Limestone Chalet would require obtaining a permit from the MDEQ for digging a new well adjacent to the facility to serve its domestic water needs. The existing wells would be able to accommodate an increase in demand at their respective facilities, as currently there is enough water (22,400 gpd) to serve this increase in demand.

Wastewater

Construction of the Limestone Chalet would also require a permit from MDEQ and would entail the construction of a small, on-site wastewater treatment system. The chalet is anticipated to accommodate approximately 800 people per day. On peak days, it could accommodate as many as 960 people. As a result, the discharge to groundwater system would have the capacity of approximately 3,000 gpd, to accommodate the current rate of three gallons per person per day.

Power

With selection and implementation of Alternative 2, Bridger Bowl would remove one lift (Alpine), install four new chairlifts (A-1, A-2, N-1, and S-1) and two surface lifts (P-2 and P-3), and upgrade the Bridger Lift. Alternative 2 would also entail construction of the Limestone Chalet, which would utilize electricity for lights, heating, and cooking. Northwestern Energy has indicated that the existing power infrastructure is adequate to accommodate up to a 50 percent increase in demand over existing conditions (Cole, 2003).

Several short spurs from the existing lines would be required to reach the proposed lifts and the Limestone Chalet. To provide power to the bottom and lower terminals of proposed lift S-1 and the lower terminal of proposed surface lift P-2, a buried power line would tie in to the existing power line that ends at the bottom of the Pierre's Knob Lift. This proposed power line would follow a mountain access road (portions of which are existing and proposed) to reach the lower terminal of the proposed S-1 Lift (approximately 7,394 feet in length). This line would then continue up the lift corridor to provide power to the top terminal of the S-1 Lift (approximately 1,865 feet in length). A third spur would then run from the upper terminal of S-1 to power the lower terminal of the proposed P-2 surface lift (approximately 76 feet in length).

To provide power to the relocated top terminal of the Deer Park lift, a spur would be trenched into an existing mountain access road; this would tie into the existing buried power line within the Bridger Lift corridor (approximately 484 feet in length). Power to

the A-1 lift would be delivered via the existing overhead power line to Alpine Lift. The line would also be extended to the top of the A-2 Lift.

Power to the lower terminal of the N-1 Lift and Limestone Chalet would be delivered from the lower terminal of the A-2 lift. Power to the upper terminal of N-1 and lower terminal of P-3 would be delivered from the top terminal of A-2 Lift. For example, power to the N-1 lift would be constructed when the N-1 lift is constructed, even if the A-1 A-2 lifts had not yet been installed.

Fuel Storage

There is adequate fuel storage at the maintenance shop and in the base area to accommodate the proposed improvements to the resort. Additional lift infrastructure, each with its own APU, would create a minor increase in demand for additional diesel fuel; the storage tank at the maintenance shop would be refilled more frequently as necessary. Because the Limestone Chalet and the lift shacks associated with the proposed lifts would be heated via electricity, there would be no increase in demand for propane at these facilities.

Mountain Access Roads

Selection and implementation of Alternative 2 would result in the construction of seven new road segments for lift construction and maintenance access. These roads would be short spurs off of the existing mountain road network. One spur would be constructed from the end of the existing road in Trail 14 and continue to the bottom terminal of the proposed S-1 Lift (approximately 3,273 feet in length). To access the Limestone Chalet, a spur would be constructed from the existing road in Trail 54 (approximately 789 feet in length). A third spur would be constructed from the existing road accessing the top terminal of the Alpine lift to the top terminal of the A-2 lift (approximately 1,181 feet in length). A fourth spur would be constructed form the top terminal of the existing Alpine Lift to the top terminal of the proposed N-1 Lift (approximately 2,300 feet in length). The fifth spur would run from the top terminal of N-1 to the bottom terminal of the proposed P-3 surface lift (approximately 243 feet in length). The total length of proposed road segments would be approximately 1.8 miles.

4.14.3 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 3

The effects to infrastructure and utilities under Alternative 3 would be identical for domestic water, wastewater, and fuel storage as those disclosed under Alternative 2. Guest services CCC would increase to 6,200 skiers under all action alternatives with construction of the Limestone Chalet. Because Alternative 3 does not include the expansion into the Slushman Drainage, there would be no S-1 or P-2 lifts. As a result, there would be a reduced increase in demand for electricity. Additionally, there would be no road necessary to the S-1 Lift for construction and maintenance access. Road construction under Alternative 3 would create approximately1.1 miles of new roads.

4.14.4 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 4

The effects to infrastructure and utilities under Alternative 4 would be identical for domestic water, wastewater, and fuel storage as those disclosed under Alternative 2. With no expansion into Bradley Meadow, the N-1 and P-3 lifts would not be constructed; however, the Limestone Chalet would remain part of the proposal. As a result, guest services CCC would increase to 6,200 skiers. There would be a reduced increase in demand for electricity at the resort as compared to Alternative 2. Additionally, there would be no road necessary to the N-1 Lift for construction and maintenance access. Road construction under Alternative 4 would create approximately1.1 miles of new roads.

4.14.5 FOREST PLAN CONSISTENCY

No Forest Plan standards or guidelines have been outlined for infrastructure and utilities either forest-wide or for MA 2. However, direction for facilities under MA 2 requires that new roads be constructed and maintained in accordance with management area goals. Implementation of the action alternatives would be consistent with this standard; therefore, the proposal would be consistent with Forest Plan direction.

4.15 NOISE

The primary sources of existing noise at Bridger Bowl include traffic noise and other noises that are characteristic of ski resorts such as snowmaking, grooming, and avalanche hazard reduction. Increases in these factors as a result of the action alternatives would likely result in an overall increase in sound level energy in the Bridger Bowl area.

4.15.1 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 1

Under Alternative 1, no change would be anticipated in the noise sources or levels at Bridger Bowl. The primary sources of noise at Bridger Bowl would remain maintenance activities, equipment operation, vehicular traffic, explosives used for avalanche hazard reduction and trail modifications, snowmaking activities, and recreational users of the facilities.

4.15.2 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 2

Noise impacts at Bridger Bowl are not expected to increase appreciably with the proposed project elements under Alternative 2. Construction activities associated with the installation of the new lifts and ski trail development in the Slushman Drainage and the SF Bracket Creek Drainage would generate an increase in operational noise levels at Bridger Bowl; however, these would be temporary and short-term in nature. Increased levels of operation over the long term would be anticipated as a result of increased operational activities and traffic on local roadways.

Construction Impacts

Under Alternative 2, noise associated with excavation and construction of new chairlifts, trails, and buildings would be the most noticeable impacts associated with the project. Typically during construction, there would be a temporary increase in noise impacts due to the use of heavy equipment and hauling of materials. Noise levels resulting from such construction would depend on the intensity of the construction activity (i.e., the amount and types of construction equipment being used) and the duration of the construction activity.

The types of equipment used for this project would typically generate noise levels between 80 and 90 dBA at a distance of 50 feet while equipment is operating. Construction equipment operation can vary from intermittent to fairly continuous, with multiple pieces of equipment operating concurrently. Assuming that two trucks (90 dBA), a scraper-grader (87 dBA), a moveable crane (82 dBA), a compactor/roller (73 dBA), and a tractor (85 dBA) are operating in the same area, peak construction-period noise would generally be about 93 dBA at 50 feet from the construction site.

Table 4.15-1 summarizes predicted construction noise levels at various distances from the construction site, conservatively assuming no atmospheric absorption or attenuation by trees and accounting for the attenuation of coniferous trees. Foliage and ground cover are assumed to provide attenuation of up to 14 dBA according to a study by the Forest

Service (Harrison, 1980). Daytime summer background noise levels in coniferous forest are typically 35-45 dBA (Harrison, 1980).

Table 4.15-1
Construction Noise Levels Near a Typical Construction Site

Distance from Construction Site (ft)	Line-of-sight Noise Level (dBA)	Noise Level with Tree Attenuation (dBA)
50	93	93
100	87	75
200	81	69
400	75	61
800	69	55
1,600	63	49
3,200	57	43
6,400	51	37

Construction noise impacts would be localized and generally limited to daytime hours during the summer months. There would be no additional noise impacts in the surrounding areas during evening or nighttime hours. A helicopter may be used for installation of some chairlift towers. During this period, localized sound levels would be high relative to other times of the year. At the closest point, the Bridger Pines subdivision boundary is approximately 2,500 feet from the bottom terminals of the proposed A-1 and A-2 chairlifts. In this case, temporary daytime construction levels are estimated to be approximately 60 dBA at 2,500 feet. Those levels are higher than typical daytime background levels of 35-45 dBA. As a result, construction noise may be audible to property owners in the residential areas at the base of Bridger Bowl.

Big game and other wildlife could temporarily move to more quiet areas in the surrounding forestlands during the period of helicopter (or other construction) operations. It is unlikely that there would be any long-term adverse impact from this noise source (see Section 4.7–Wildlife).

Operational Impacts

Operational activities under Alternative 2 would nominally increase noise levels at Bridger Bowl. Following build-out of the project, sounds would be similar to those that are currently experienced in the SUP area, including the operation of chairlifts, snow groomers, and vehicle traffic. Sound levels would be slightly elevated over existing conditions due to the more developed nature of the site. A doubling of sound energy (3 dBA) is generally considered the level of human perception. It is not expected that daytime operation levels will increase by more than 3 dBA with implementation of the project; therefore, no noticeable impact would be expected. The use of blasting for avalanche hazard reduction under all action alternatives would be similar in dBA and

duration to existing conditions, but it would likely be more frequent as a result of the expansion into the Slushman Drainage, which is prone to avalanche activity.

As disclosed under the discussions of air quality and transportation, an increase in vehicular traffic would be expected under all action alternatives. Though peak noise levels associated with traffic would likely remain constant, the duration of traffic related noise would likely increase slightly above current levels.

4.15.3 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 3

Alternative 3 would be similar to Alternative 2 except that there would be no development in the Slushman Drainage. This equates to no construction of the S-1 and P-2 lifts and no development of the S-1 through S-4 trails. Additionally, there would be no increase in avalanche hazard reduction work at Bridger Bowl without the expansion into the Slushman Drainage. Therefore, noise impacts associated with the Alternative 3 would be less than those disclosed under Alternative 2.

4.15.4 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 4

Alternative 4 would be similar to Alternative 2 except that there would be no development in the SF Brackett Creek Drainage. This equates to no construction of the N-1 or P-3 lifts and no development of the N trails. There would be a slight increase in the use of blasting for avalanche hazard reduction in Alternative as a result of the expansion into the Slushman Drainage, which is prone to avalanche activity, but it would be similar in dBA and duration in comparison to existing conditions. Noise impacts associated with the Alternative 4 would still be less than those disclosed under Alternative 2.

4.15.5 FOREST PLAN CONSISTENCY

No Forest Plan standards or guidelines have been outlined for noise either forest-wide or for MA 2.

4.16 CUMULATIVE EFFECTS

Cumulative effects are an aggregate of many direct and indirect effects and include actions, which have occurred in the past or can reasonably be expected to occur. For most resources, the Bridger Bowl Study Area is the primary scope of cumulative effects analysis. However, for soils, water resources, vegetation, wildlife, and fisheries, the scope has been broadened to accommodate the analysis needs of each resource (i.e., watershed, timber compartment, and Lynx Analysis Unit). The Forest Service has identified past (ten years), present, and reasonably foreseeable future actions within or adjacent to the study area; these are identified below, and a description of the potential cumulative impacts to each resource follows.

4.16.1 PRIVATE LAND DEVELOPMENT

Bridger Pines

Bridger Pines is a housing development in the Bridger Creek watershed on private lands. Several home sites are still unoccupied and additional residential development may occur within the subdivision in the future.

Bridger Park

The Bridger Park subdivision was approved in April 1998 for 30 single-family dwellings (these homes sites are approximately 4.8 acres each), and there is approximately 117 acres of open space within the development.

360 Ranch

The 360 Ranch Corporation has submitted plans for the development of private lands to the south and east of the lands owned by Bridger Bowl, Inc. At the time of this publication, all plans have been withdrawn form consideration. As a result, this private land development is not considered a reasonably foreseeable future action.

Bohart Ranch

Bohart Ranch ski area is located on both private and NFS lands for which it has an SUP from the GNF. Some minor logging has occurred within the past ten years on both private and NFS lands for trail clearing. Additionally, the ranch has been put into a conservation easement. There is currently no future development planned on NFS lands in the area at this time.

Bridger Bowl base area

Since 1995, Bridger Bowl has completed several projects on its private lands to improve the existing conditions and meet the demands of today's skiers. These include expanding available parking from 900 to 1,300, installing a new wastewater treatment system, constructing a new ski patrol building adjacent to the Jim Bridger Lodge, and constructing a new Day Lodge. Also, a beginner lift (Snowflake) was constructed on

private lands adjacent to the lower portion of the Virginia City lift and additional snowmaking lines were installed near the Virginia City Lift expand the snowmaking coverage from 10 acres to 27 acres. Reasonable foreseeable future actions include development of additional parking in the base area, construction of the Limestone Chalet, and modification of the Virginia City Lift.

Incidental residential development

Residential development is regulated by the Bridger Canyon Zoning Ordinance. Although there are numerous adjacent private land owners, future development would likely be limited to single-family dwellings on these properties.

Timber Harvests

Big Sky Lumber harvest

Between 1993 and 1994, the Big Sky Lumber (BSL) Corporation conducted logging in sections 1 and 7 in the Slushman drainage within the Bridger Creek watershed. Over the duration of the project, approximately two million board feet were harvested.

Timber harvests and grading projects within Bridger Bowl SUP

Two timber harvests were completed for glade skiing, trail maintenance, and a free style jump site on NFS lands within the developed ski area between 1997 and 1999. Approximately 23,380 board feet were removed from 1.5 acres for the ski jump, and about 68,000 board feet were removed over a 61-acre area to improve glade skiing and maintain ski trails. Additionally, some grading occurred in 2001 when the Pierre's Knob Lift was realigned and the top terminal replaced; this project included removing about 132,000 board feet of timber from an area of about 10 acres.

Grazing Allotment

Brackett Creek allotment

This grazing allotment is located north of Bridger Bowl in the Brackett Creek watershed on 5,072 acres, of which 2,236 are NFS lands. Grazing occurs from July 1 through October 15 annually and is allocated for 60 head of cattle. The current and projected utilization rate is 45 percent.

Brackett Creek Land Exchange

An Environmental Assessment is being prepared to analyze the proposed land exchange of approximately 714 acres of private land and approximately 603 acres of NFS lands as part of the Brackett Creek Land Exchange. The purpose of the exchange is to reduce the number of isolated parcels of NFS lands land intermingled with private lands; ensure future public and administrative access to NFS; reduce trespass associated problems on private lands, and protect resource values on both acquired and conveyed lands. Upon completion of the land exchange, approximately six miles of public access roads will be

constructed or reconstructed providing public access in this area all on NFS lands. The private land owner has stipulated that development of the acquired land will result in a private family retreat with no more than six clustered residential homes and a barn. The analysis is expected to be competed by the end of 2004.

4.16.2 GEOLOGY AND SOILS

The scale of the cumulative effects analysis for geology and soil is SF Brackett Creek Watershed and the Upper Bridger Creek Watershed. For the purpose of this analysis, the Upper Bridger Creek Watershed includes Upper Bridger Creek, Maynard Creek, and Slushman Creek. Cumulative effects on soils include the existing or baseline conditions described in Section 3.2 – Geology and Soils, those impacts associated with the Bridger Bowl SDEIS described in Section 4.2 – Geology and Soils, and other past, present, and reasonably foreseeable projects identified in the introduction to this cumulative effects section. These other projects include projects not associated with the Bridger Bowl SDEIS and have already, currently are, or are going to occur on lands within the SF Brackett Creek and Upper Bridger Creek Watersheds.

Due to the closely related processes between soil erosion, sediment yield to streams, and the resulting effects to water quality and fisheries, the cumulative effects analysis for these processes are not included in this section. Instead, impacts to these processes are analyzed in the water resources and fisheries sections where the impacts from soil erosion would likely occur. The cumulative effects analysis for soil is therefore focused on impacts to soil productivity in the SF Brackett Creek and Upper Bridger Creek Watersheds.

Alternative 1

With implementation of Alternative 1, no impacts would occur to geology and soil resources, so the only cumulative effects on soil productivity under Alternative 1 include the past, current, and reasonably foreseeable projects not related to the Bridger Bowl SDEIS that would occur. According to analysis completed for the R1R4 sediment model, approximately 95.4 acres of productive soils in the SF Brackett Creek Watershed and the Upper Bridger Creek Watershed have been permanently impacted due to the past Bridger Bowl and other cumulative impacts of projects list in the beginning of this section. These past impacts to soil productivity represent approximately 1.6 percent of the land area in these watersheds. Since the soil productivity impacts from known future cumulative effects projects can not be accurately quantified, conservative estimates of permanent soil productivity impacts from proposed buildings, roads, and parking lots have been made. For the purposes of this analysis, it is assumed that future soil productivity impacts from the remaining lots at Bridger Pines subdivision would be approximately five acres, the Bridger Park subdivision would be approximately 30 acres, and 15 acres for potential road impacts from the Brackett Creek Land Exchange. Therefore, the cumulative effects to soil productivity from all known past, present, and reasonably foreseeable projects under Alternative 1 would be 145.4 acres, which is approximately 2.36 percent of the SF Brackett Creek and the Upper Bridger Creek Watersheds.

Alternative 2

Under Alternative 2, approximately 7.0 acres of permanent impacts to soil productivity would occur within the SF Brackett Creek and Upper Bridger Creek Watersheds. In addition, approximately 57.3 of temporary clearing and grading impacts to soil productivity would occur. Since these impacts would be temporary in nature and the soil productivity would return to these sites over time, temporary soil productivity impacts are not considered in this cumulative effects analysis. The approximately 7.0 acres of permanent impacts to soil productivity proposed under Alternative 2 represent approximately 0.1 percent of the land area in these watersheds. The combined cumulative impacts from all past and future Bridger Bowl and other known projects under Alternative 2 would be 152.4 acres, which is approximately 2.47 percent of the SF Brackett Creek and the Upper Bridger Creek Watersheds.

Alternative 3

Cumulative impacts on soil productivity in the SF Brackett Creek and Upper Bridger Creek Watersheds from Alternative 3 would be less than Alternative 2 because there would be no road or building construction in the Slushman Drainage. The total permanent impacts to soil productivity under Alternative 3 would be approximately 5.3 acres, which represents less than 0.1 percent of the SF Brackett Creek and Upper Bridger Creek Watersheds. The combined cumulative impacts from all past and future Bridger Bowl and other known projects under Alternative 3 would be 150.7 acres, which is approximately 2.45 percent of the SF Brackett Creek and the Upper Bridger Creek Watersheds.

Alternative 4

Under Alternative 4, the cumulative impacts on soil productivity in the SF Brackett Creek and Upper Bridger Creek Watersheds would be less than Alternative 2 but more than Alternative 3 because there would be no road or building construction for the lifts and trails in the Bradley Meadows area but the construction in the Slushman Drainage would still occur. The total permanent impacts to soil productivity under Alternative 4 would be approximately 5.4 acres, which represents less than 0.1 percent of the SF Brackett Creek and Upper Bridger Creek Watersheds. The combined cumulative impacts from all past and future Bridger Bowl and other known projects under Alternative 3 would be 150.8 acres, which is also approximately 2.45 percent of the SF Brackett Creek and the Upper Bridger Creek Watersheds.

4.16.3 WATER RESOURCES

The cumulative effects analysis of water resources presented below includes the following topics: stream channels, wetlands, water quantity, and water quality. The scale of the cumulative effects analysis for water resources is the SF Brackett Creek Watershed and the Upper Bridger Creek Watershed. For the purpose of this analysis, the Upper Bridger Creek Watershed includes Upper Bridger Creek, Maynard Creek, and Slushman Creek. Cumulative effects on waters resources include the existing conditions described

in Section 3.3 – Water Resources, those impacts associated with the Bridger Bowl SDEIS described in Section 4.3 – Water Resources, and other past, present, and reasonably foreseeable projects identified in the introduction to this cumulative effects section. These other projects include projects not associated with the Bridger Bowl SDEIS and have already, currently are, or are going to occur on lands within the SF Brackett Creek and Upper Bridger Creek Watersheds.

South Fork Brackett Creek Watershed

Alternative 1

With implementation of Alternative 1, there would be no impacts to water resources, so there would be no additional direct impacts to stream channels or wetlands in the SF Brackett Creek watershed. The result of past projects on stream channels and wetlands are incorporated into the descriptions of existing stream channel and wetland conditions that are located in Section 3.3 – Water Resources. Since there would be no additional impacts to stream channels and wetlands under Alternative 1, the only cumulative effects on stream channels and wetlands under Alternative 1 would include the reasonably foreseeable projects described in the introduction to this section that would occur within the SF Brackett Creek Watershed. The Brackett Creek Grazing Allotment and the Brackett Creek Land Exchange have the potential to impact stream channels and wetlands in the future. However, the information that is currently available for these projects does not provide sufficient detail to determine specific impacts to stream channels and wetlands for this cumulative effects analysis. It is anticipated that any potential impacts to stream channels and wetlands from these projects would have minimal cumulative effects at the watershed scale because in-channel work would be performed in accordance with conditions of a 310 Permit from the MDEQ, any proposed wetland impacts would need a Section 404 permit from the U.S. Army Corps of Engineers, and any future work in a Stream Management Zone (SMZ) would follow all applicable mitigation measures and BMPs specified. Based on the analysis of impacts from all known past, present, and reasonably foreseeable projects in the SF Brackett Creek Watershed, there would be no cumulative impacts to stream channels or wetlands from implementation of Alternative 1.

Under Alternative 1, no construction activities would occur, so the only cumulative effects on water quantity would include the past, present, and reasonably foreseeable projects not related to the Bridger Bowl SDEIS that would occur within the SF Brackett Creek Watershed. Past timber harvest by Bohart Ranch is a cumulative effects project described in the introduction to this section that was incorporated into the water yield model. The Brackett Creek Grazing Allotment was not incorporated into the water yield model because grazing does not affect the variables in the model. No other past projects have been identified that would affect the water yield model. The only future project identified in the SF Brackett Creek watershed that could affect the water yield model is the Brackett Creek Land Exchange. This project was not incorporated into the water yield model because the information that is currently available for this project does not provide sufficient detail to be used in the model. Based on the assessment of the cumulative effects projects in the SF Brackett Creek watershed, the cumulative effects on

water quantity under Alternative 1 are adequately addressed by the water yield analysis of existing conditions in Section 3.3 – Water Resources. As stated in Section 3.3 – Water Resources, the annual water yield in SF Brackett Creek is currently 0.07 percent above natural conditions which reflects the limited amount of development in this watershed.

The R1R4 sediment model was used establish existing water quality conditions in a cumulative fashion accounting for all existing roads, timber harvest units, in the SF Brackett Watershed. The Brackett Creek Grazing Allotment was not included in the R1R4 sediment model because the model inputs are based primarily on land disturbance activities. The Brackett Creek Land Exchange is a future project in the SF Brackett Creek Watershed that could affect the R1R4 sediment model. However, this project was not incorporated into the sediment model because the information that is currently available for this project does not provide sufficient detail to be used in the model. No other reasonably foreseeable projects have been identified within the SF Brackett Creek Watershed that would affect the inputs in the R1R4 sediment model. Therefore, the analysis of cumulative effects on water quality in the SF Brackett Creek Watershed is adequately addressed by the R1R4 sediment model, which addresses the Proposed Action and other past projects at the watershed scale. The SF Brackett Creek sediment delivery rate is currently estimated at 8.2 percent over natural conditions with the existing road network. According to the 1999 MOU discussed in Chapter 3, the GNF sediment constraint for accelerated sediment delivery is 30 percent over natural conditions on an annual basis for the SF Brackett Watershed. The modeled sediment delivery rate for existing conditions is 8.2 percent over natural conditions for SF Brackett Creek. Therefore, the cumulative effects from all past Bridger Bowl and other projects within the SF Brackett Creek Watershed have resulted in sediment yields that are within the GNF standards for water quality.

Alternatives 2 and 3

The cumulative effects analysis for the SF Brackett Creek Watershed discusses alternatives 2 and 3 together because the potential impacts to water resources in this watershed would be identical for both alternatives. Under alternatives 2 and 3 there would be no new stream channel impacts from road crossings or other in-channel work in the SF Brackett Creek Watershed. Therefore, the cumulative effects to stream channels would be as described under Alternative 1.

Under alternatives 2 and 3 no grading or filling activities in wetlands are proposed, so the area and distribution of wetlands within SF Brackett Creek Watershed would remain unchanged. However, approximately 0.48 acres of direct impacts to wetlands would occur from vegetation removal. Implementation of mitigation measures VM-3, VM-4, and VM-6 avoid and/or minimize direct and incidental indirect impacts to wetlands. Since the proposed wetland impacts would not significantly affect the topography, hydrology source, or understory vegetation for these wetlands, implementation of Alternative 2 and 3 would not significantly affect wetland functions that can affect watershed process, such as surface water storage, sediment filtration, and moderation of groundwater flow. As stated above under Alternative 1, no known ongoing or reasonably foreseeable cumulative effects projects would impact wetlands in the SF Brackett Creek

Watershed. Based on the analysis of impacts from all known past, present, and reasonably foreseeable projects in the SF Brackett Creek Watershed, it is likely that the site scale clearing impacts to wetlands proposed under alternatives 2 and 3 would not result in cumulative impacts to wetlands or water quantity or quality in the SF Brackett Creek Watershed.

The forest clearing and road building activities proposed under alternatives 2 and 3 would increase water yield in SF Brackett Creek Watershed by 1.0 percent above natural conditions, which is 0.8 percent above existing conditions. The projected increase in water yield above existing conditions is considered too small to be measurable at the watershed scale. Therefore, alternatives 2 and 3 would not change the water yield enough to create any additional channel scour or other impacts to streams. As stated above under Alternative 1, no ongoing or reasonably foreseeable cumulative effects projects would increase water yields in SF Brackett Creek Watershed. Based on the analysis of impacts from all known past, present, and reasonably foreseeable projects in the SF Brackett Creek Watershed, there would be no cumulative impacts to water yield from implementation of alternatives 2 and 3 other than the impacts previously disclosed for these alternatives.

The maximum sediment delivery due to construction activities proposed under alternatives 2 and 3 is estimated to increase delivery rates by 1.6 tons per year, which is 1.8 percent above existing conditions and 10.1 percent over natural conditions. The sediment increase in SF Brackett Creek would decrease to 8.4 percent over natural rates by 2011. The modeled sediment delivery rate for alternatives 2 and 3 for SF Brackett Creek is well below the 30 percent standard set by the GNF to meet conditions for Class A streams and the 1999 MOU. As stated above under Alternative 1, no ongoing or reasonably foreseeable cumulative effects projects would increase sediment delivery to the SF Brackett Creek Watershed. Based on the analysis of impacts from all known past, present, and reasonably foreseeable projects in the SF Brackett Creek Watershed, there would be no cumulative impacts to water quality from implementation of alternatives 2 and 3 other than the impacts previously disclosed for these alternatives.

Alternative 4

There would be no direct or indirect impacts to stream channels, wetlands, water quantity, or water quality in the SF Brackett Creek Watershed as a result of project implementation under Alternative 4. Therefore, the only cumulative effects on water resources under Alternative 4 include the past, present, and reasonably foreseeable projects not related to the Bridger Bowl SDEIS that would occur within the SF Brackett Creek Watershed. The cumulative effects of these projects are presented above in the analysis for Alternative 1.

Upper Bridger Creek Watershed

Alternative 1

With implementation of Alternative 1 there would be no impacts to water resources, so there would be no additional direct impacts to stream channels or wetlands in the Upper Bridger Creek Watershed. Since there would be no additional impacts to stream channels and wetlands under Alternative 1, the only cumulative effects on stream channels and wetlands under Alternative 1 would include the reasonably foreseeable projects described in the introduction to this section that would occur within the Upper Bridger Creek Watershed. The residential developments that may occur within the Bridger Pines subdivision and the Bridger Park subdivision have the potential to impact stream channels and wetlands in the future. However, the information that is currently available for these projects does not provide sufficient detail to determine specific impacts to stream channels and wetlands for this cumulative effects analysis. It is anticipated that any potential impacts to stream channels and wetlands from these projects would have minimal cumulative effects at the watershed scale because in-channel work would be performed in accordance with conditions of a 310 Permit from the MDEQ, any proposed wetland impacts would need a Section 404 permit from the U.S. Army Corps of Engineers, and any future work in a Stream Management Zone (SMZ) would follow all applicable mitigation measures and BMPs specified. Based on the analysis of impacts from all known past, present, and reasonably foreseeable projects in the Upper Bridger Creek Watershed, there would be no cumulative impacts to stream channels or wetlands from implementation of Alternative 1.

Since no construction activities would occur under Alternative 1, the only cumulative effects on water quantity in the Upper Bridger Creek Watershed would include the past, present, and reasonably foreseeable projects not related to the Bridger Bowl SDEIS. Past timber harvest for the Bridger Pines subdivision, the Big Sky Lumber Harvest, and timber harvest and road building in the Bridger Bowl Base Area were incorporated into the water yield model. No other past projects have been identified that would affect the water yield model. The only future project identified in the Upper Bridger Creek Watershed that could affect the water yield model is the Bridger Park Subdivision and final build-out of the Bridger Pines subdivision. These projects were not incorporated into the water yield model because these project areas already have a high density of roads and sparse forest cover and so additional timber harvest and road building in these areas may not measurable by the water yield model. In addition, the information that is currently available for these projects does not provide sufficient detail to be used in the model. Based on the assessment of the cumulative effects projects in the Upper Bridger Creek Watershed, the cumulative effects on water quantity under Alternative 1 are adequately addressed by the water yield analysis of existing conditions in Section 3.3 – Water Resources. Developments in these watersheds have increased current water yield to an estimated 0.7 percent in Maynard Creek, 0.6 percent increase in Slushman Creek, and 0.3 percent in Upper Bridger Creek. Peak snowmelt runoff discharge in Maynard Creek is likely greater than the model predicts since the existing watershed developments are more efficient at conveying overland flow to the stream system.

Under Alternative 1, no Bridger Bowl MDP impacts would occur, so the only cumulative effects on water quality under Alternative 1 include the past, present, and reasonably foreseeable projects not related to the Bridger Bowl SDEIS that would occur within the Upper Bridger Creek Watershed. All of the known cumulative effects projects that have occurred in the recent past were incorporated into the R1R4 sediment yield analysis, including recently completed development in the Bridger Bowl Base Area, timber harvest by Bridger Bowl for trail development, past Bridger Pines development, and the Big Sky Lumber Harvest. The reasonably foreseeable projects identified within the Upper Bridger Creek Watershed are primarily small residential development projects in the Bridger Park subdivision and the remaining undeveloped home sites in the Bridger Pines subdivision. The future development of single family homes in these subdivisions would not likely result in measurable sediment yield impacts to the Upper Bridger Creek Watershed because of the small size, and staggered timeframe of the housing sites. In addition, these development projects will have to follow the provisions of the Montana Streamside Protection Act, included observation of the 50 foot-wide Stream Management Zones.

Since the known reasonably foreseeable projects that have been identified within the Upper Bridger Creek Watershed are not likely to affect the R1R4 sediment model, the analysis of cumulative effects on fisheries in the Upper Bridger Creek Watershed is adequately addressed by the sediment model, which addresses the impacts of the action alternatives and other past projects at the watershed scale. The three tributaries to the mainstem of Bridger Creek analyzed by the R1R4 sediment model do not have any documented fish presence and are all considered Class D streams by the GNF. According to GNF guidelines, to protect Class D streams, sediment increases should not exceed 100 percent above natural rates. According to estimates from the R1R4 model, the existing sediment yield to the three tributaries to the mainstem of Bridger Creek range from 27 to 77 percent above natural conditions. Therefore, the cumulative effects from all past Bridger Bowl and other projects within the Upper Bridger Creek Watershed have resulted in sediment yields that are within the GNF standards for Class D streams.

Alternative 2

Under Alternative 2, there is a proposed stream crossing for a new road that would be located in the Slushman Drainage. Mitigation measure RP-1 in Table 2.6-1 would minimize potential channel impacts and indirect sediment impacts. In addition, a list of required BMPs and agency guidelines are included in the Implementation and Monitoring Plan in Appendix D of this document. Based on proper implementation of the mitigation measures and BMPs and the lack of documented fish presence and habitat in this potion of Slushman Creek, it is unlikely that the proposed road crossing would have any measurable effects to channel morphology or integrity at the watershed scale. As stated above under Alternative 1, no known ongoing or reasonably foreseeable cumulative effects projects would impact stream channels in the Upper Bridger Creek Watershed. Based on the analysis of impacts from all known past, present, and reasonably foreseeable projects in the Upper Bridger Creek Watershed, it is likely that the site scale channel impacts in Slushman Creek proposed under Alternative 2 would not result in

cumulative impacts to stream channels or water quality in the Upper Bridger Creek Watershed.

Under Alternative 2 there would be no new wetland impacts from road building or lift and trail construction in the Upper Bridger Creek Watershed. Therefore, the cumulative effect to wetlands in the Upper Bridger Creek Watershed would be as described under Alternative 1.

The forest clearing and road building activities proposed under Alternative 2 would increase water yield in the three tributaries to the mainstem of Bridger Creek in a range from 0.2 percent to 1.0 percent above natural conditions, which is 0.1 percent to 0.8 percent above existing conditions.. The projected increase in water yield above existing conditions is considered too small to be measurable at the watershed scale. Therefore, Alternative 2 would not change the water yield enough to create any additional channel scour or other impacts to streams. As stated above under Alternative 1, no ongoing or reasonably foreseeable cumulative effects projects would increase water yields in Upper Bridger Creek Watershed. Based on the analysis of impacts from all known past, present, and reasonably foreseeable projects in the Upper Bridger Creek Watershed, there would be no cumulative impacts to water yield from implementation of Alternative 2 other than the impacts previously disclosed for this alternative.

The maximum sediment delivery due to construction activities proposed under Alternative 2 is estimated to increase delivery rates to the three tributaries to the mainstem of Bridger Creek by 1.5 to 3.5 tons per year, which is 28.4 to 83.9 percent over natural conditions. Increases in sediment yield as a result of activities proposed under Alternative 2 would not exceed the 100 percent above natural rates guidelines of the GNF. Therefore, this level of sediment delivery within Upper Bridger Creek Watershed would have extremely limited, if any, negative effect on water quality. As stated above under Alternative 1, no ongoing or reasonably foreseeable cumulative effects projects would increase sediment delivery to the Upper Bridger Creek Watershed. Based on the analysis of impacts from all known past, present, and reasonably foreseeable projects in the Upper Bridger Creek Watershed, there would be no cumulative impacts to water quality from implementation of Alternative 2 other than the impacts previously disclosed for this alternative.

Alternative 3

Under Alternative 3 there would be no new stream channel or wetland impacts from road crossings or lift and trail construction in the Upper Bridger Creek Watershed. Therefore, the cumulative effect to stream channels and wetlands in the Upper Bridger Creek Watershed would be as described under Alternative 1.

The projected increases in water yield as a result of activities proposed under Alternative 3 would be the same as Alternative 2 for Maynard and Upper Bridger Creeks. The projected increases in water yield in Maynard and Upper Bridger Creeks would only are considered too small to be measurable. No construction activities are proposed in the Slushman watershed under Alternative 3, so there would be no new impacts to water

yield in Slushman Creek. Similar to Alternative 2, Alternative 3 would not change the water yield enough to create any additional channel scour or other impacts to streams. As stated above under Alternative 1, no ongoing or reasonably foreseeable cumulative effects projects would increase water yields in Upper Bridger Creek Watershed. Based on the analysis of impacts from all known past, present, and reasonably foreseeable projects in the Upper Bridger Creek Watershed, there would be no cumulative impacts to water yield from implementation of Alternative 2 other than the impacts previously disclosed for this alternative.

Sediment delivery impacts to Maynard and Upper Bridger Creeks under Alternative 3 would be the same as in Alternative 2. Under Alternative 3 there would be no increase in sediment delivery to Slushman Creek. Since the increases in sediment delivery under Alternative 3 would be the same as or less than Alternative 2, sediment delivery under Alternative 3 would not exceed the 100 percent above natural rates guidelines of the GNF. Therefore, this level of sediment delivery within Upper Bridger Creek Watershed would have extremely limited, if any, negative effect on water quality. As stated above under Alternative 1, no ongoing or reasonably foreseeable cumulative effects projects would increase sediment delivery to the Upper Bridger Creek Watershed. Based on the analysis of impacts from all known past, present, and reasonably foreseeable projects in the Upper Bridger Creek Watershed, there would be no cumulative impacts to water quality from implementation of Alternative 2 other than the impacts previously disclosed for this alternative.

Alternative 4

Under Alternative 4 there would be one new stream channel crossing in the Upper Bridger Creek Watershed for the proposed road that is needed to access the proposed S-1 chairlift. The potential stream channel impacts under Alternative 4 would be the same as proposed under Alternative 2, so the cumulative impacts to stream channels in the Upper Bridger Creek Watershed would be as described under Alternative 2.

Under Alternative 4 there would be no new wetland impacts from road building or lift and trail construction in the Upper Bridger Creek Watershed. Therefore, the cumulative effect to wetlands in the Upper Bridger Creek Watershed would be as described under Alternative 1.

The forest clearing and road building activities proposed under Alternative 4 would increase water yield in the three tributaries to the mainstem of Bridger Creek in a range from 0.1 percent to 0.2 percent above existing conditions. The projected increase in water yield above existing conditions is considered too small to be measurable at the watershed scale. Therefore, Alternative 4 would not change the water yield enough to create any additional channel scour or other impacts to streams. As stated above under Alternative 1, no ongoing or reasonably foreseeable cumulative effects projects would increase water yields in Upper Bridger Creek Watershed. Based on the analysis of impacts from all known past, present, and reasonably foreseeable projects in the Upper Bridger Creek Watershed, there would be no cumulative impacts to water yield from

implementation of Alternative 4 other than the impacts previously disclosed for this alternative.

Sediment delivery impacts to Slushman Creek under Alternative 4 would be the same as in Alternative 2. Under Alternative 3 sediment delivery to Maynard and Upper Bridger Creeks would be less than under Alternative 2 with an increase of 1.3 tons per year and 2.4 tons per year respectively. Since the increases in sediment delivery under Alternative 4 would be the same as or less than Alternative 2, sediment delivery under Alternative 4 would not exceed the 100 percent above natural rates guidelines of the GNF. Therefore, this level of sediment delivery within Upper Bridger Creek Watershed would have extremely limited, if any, negative effect on water quality. As stated above under Alternative 1, no ongoing or reasonably foreseeable cumulative effects projects would increase sediment delivery to the Upper Bridger Creek Watershed. Based on the analysis of impacts from all known past, present, and reasonably foreseeable projects in the Upper Bridger Creek Watershed, there would be no cumulative impacts to water quality from implementation of Alternative 4 other than the impacts previously disclosed for this alternative.

4.16.4 VEGETATION

The scale of the cumulative effects analysis for vegetation includes Timber Compartments 504 and 515 and is referred to as the FAA (FAA). Cumulative effects on vegetation include the existing or baseline conditions described in Section 3.4 – Vegetation, those impacts associated with the Bridger Bowl SDEIS described in Section 4.4 – Vegetation, and other past, present, and reasonably foreseeable projects identified in the introduction to this cumulative effects section. These other projects include projects not associated with the Bridger Bowl SDEIS and have already, currently or may occur on lands within the FAA.

Alternative 1

With implementation of Alternative 1, no impacts would occur to vegetation, so the only cumulative effects would include the past, present, and reasonably foreseeable projects not related to the Bridger Bowl SDEIS that would occur within the FAA and are described in the introduction to this section. All of the known cumulative effects projects that have occurred in the recent past were incorporated into the fragmentation and old growth analysis used to analyze the impacts of the alternatives, including recently completed development in the Bridger Bowl base area, timber harvest by Bridger Bowl on NFS Lands for trail development, and the Big Sky Lumber Harvest. The Brackett Creek Grazing Allotment in an ongoing and reasonably foreseeable project that would not affect forest fragmentation or existing old growth because cattle grazing typically affects herbaceous and shrub vegetation. The reasonably foreseeable projects identified within the FAA are primarily small residential development projects located in currently fragmented areas based on interpretation of aerial photographs and GIS data. Therefore, forest fragmentation is expected to remain in a condition similar to those described in Chapter 3.4-Vegetaion in the foreseeable future.

No changes to old growth forests are likely to occur from any other future private or public actions within the next 5 to 10 years in the FAA. Over time, some increases in the dead and down woody component will occur. The additional down debris is expected to add to understory complexity and low level vertical structure. Additionally, it is likely that the amount of old growth forest would increase in the FAA over the long term because large portions of mature forests within these compartments would be allowed to grow into old growth forest.

Alternative 2

The proposed activities under Alternative 2 in the Bradley Meadows area would fragment a portion of the second largest interior forest patch in the FAA. This interior forest patch would change from an existing area of 832 acres to two smaller patches of 413 acres and 182 acres (Novak, 2003). The proposed activities under Alternative 2 would reduce interior forest within the FAA from 35 percent to 33 percent (Novak, 2003). As stated above under Alternative 1, no ongoing or reasonably foreseeable cumulative effects projects would increase forest fragmentation because all known future projects would occur in areas that are currently fragmented. Based on the analysis of impacts from all known past, present, and reasonably foreseeable projects in the FAA, there would be no additional impacts to forest fragmentation from implementation of Alternative 2 other than the impacts previously disclosed for this alternative.

Under Alternative 2, there would be approximately 17.1 acres of old growth impacts from forest clearing within the FAA. The impacts to old growth forest proposed under Alternative 2 would reduce the amount of old growth in FAA from approximately 1,464 acres to 1,447 acres, which represents a 1.2 percent change from existing conditions. No other changes to old growth forests are likely to occur from any other future private or public actions within the next 5 to 10 years in FAA. Because of past harvests in old growth and conditions present on the east side of the Bridger Mountains, existing old growth amounts in Timber Compartment 504 are below the Forest Plan standard of 10 percent. Even though this compartment in under the standard, the amount of proposed old growth forest clearing is slight in relation to the amount of old growth forest remaining in the FAA. Many of the stands identified as mature will gradually progress into old growth over time. However, it will take another 30 to 40 years for much of the mature forest that exists in the Bridger Mountains to grow into old growth. Based on the analysis of impacts from all known past, present, and reasonably foreseeable projects in the FAA, there would be no cumulative impacts to oldgrowth from implementation of Alternative 2 other than the impacts previously disclosed for this alternative.

Alternative 3

The overall impacts to vegetation communities within the FAA under Alternative 3 would be less than Alternative 2 because there would be no development in the Slushman Drainage. However, the fragmentation impacts from Alternative 3 would be identical to those from Alternative 2 because all of the impacts to interior forest patches occur in the Bradley Meadows area. Similar to Alternative 2, the interior forest patch in the Bradley Meadows area would change from an existing area of 832 acres to two smaller patches of

413 acres and 182 acres under Alternative 3 (Novak, 2003). Since the known past, present, and reasonably foreseeable projects would be the same under Alternative 3, there would be no cumulative impacts to forest fragmentation from implementation of Alternative 3 other than the impacts previously disclosed for this alternative.

Similar to the fragmentation impacts, the impact to old growth under Alternative 3 would be identical to Alternative 2. Since the known past, present, and reasonably foreseeable projects would be the same under Alternative 3, there would be no cumulative impacts to old growth from implementation of Alternative 3 other than the impacts previously disclosed for this alternative.

Alternative 4

Alternative 4 would not effect the fragmentation of interior forest in the FAA because the actions proposed would not alter interior forest in the Bradley Meadows or Slushman drainage areas. Since there would be no cumulative impacts to forest fragmentation from known past, present, and reasonably foreseeable projects, implementation of Alternative 4 would not result in any cumulative impacts to forest fragmentation.

Activities proposed under Alternative 4 would impact approximately 0.1 acres of old growth forest. The impacts to old growth forest proposed under Alternative 2 would reduce the amount of old growth in FAA by approximately 0.01 percent from existing conditions. Implementation of Alternative 4 would not result in any cumulative impacts to old growth because the proposed impacts to old growth under Alternative 4 are nearly immeasurable at the FAA scale and there are no known cumulative impacts from known past, present, and reasonably foreseeable projects.

4.16.5 WILDLIFE

Cumulative effects on wildlife include the existing or baseline conditions described in Section 3.5 – Wildlife, those impacts associated with the Bridger Bowl SDEIS, and other past, present, and reasonably foreseeable projects identified at the beginning of this section. These other projects include projects not associated with the Bridger Bowl SDEIS that have already, currently are, or are going to occur on lands within the various analysis areas used for the different animal species analyzed in this section.

Cumulative effects for wildlife species are analyzed at different scales depending on the range for each species. The analysis area for Canada lynx is the South Bridger Lynx Analysis Unit (SB LAU). The analysis area for wolverine is the Wolverine Analysis Area. The Bridger Range, which is approximately 84,480 acres, comprises the analysis area for the following species: bald eagle, gray wolf, peregrine falcon, flammulated owl, black-backed woodpecker, northern goshawk, western big-eared bat, pine marten, elk, mule deer, white-tailed deer, moose, mountain goat, black bear, mountain lion, blue grouse, ruffed grouse, and boreal owl. The Bridger Creek and Brackett Creek watersheds comprise the analysis area for the northern leopard frog and the boreal toad.

Threatened Species

Canada lynx (Lynx canadensis)

The analysis area for the Canada lynx is comprised of the SB LAU which covers approximately 18,293.85 acres and contains approximately 12,159 acres of lynx habitat (see Figure 3-5). The SB LAU is sufficiently large enough to cover the average home range size of a female lynx and it contains adequate habitat to support lynx on a year-round basis.

Denning Habitat

Cumulative effects to lynx denning habitat include past timber harvest, ski area and housing development, plus associated road building, which have removed or degraded lynx denning habitat. Effects from timber harvest for wood production are temporary, and if left to natural succession, harvest units can be expected to grow back to a condition where they again provide denning habitat. Effects of ski area and housing development are permanent. Most of the lynx habitat on private land in the base area has already been managed to some degree, to the point where it no longer provides high quality denning habitat. Development in the base area has affected less than 1 percent of the suitable denning habitat in the SB LAU. Most of the lynx denning habitat in this LAU is located on federal lands. Private lands account for only approximately 367 acres of lynx denning habitat at this time. There is potential for timber harvest and housing development on private lands to have additional effects on lynx denning habitat. However, given the small amount of denning habitat currently available on private lands, the associated risk for additional impact is considered to be low at this time, and federal lands could easily continue to provide the minimum of 10 percent denning habitat required in the Lynx Conservation Strategy (LCS).

Currently, there are 2,621 acres of lynx denning habitat available within the LAU. Under Alternative 1, there would be no additional cumulative effects to lynx denning habitat as there would be no new development at Bridger Bowl. Lynx denning habitat available within the LAU would remain at 2,621 acres.

Under Alternative 2, lynx denning habitat would decrease by approximately 288.7 acres resulting in a decrease of 11 percent in the amount of denning habitat available in the LAU.

Under Alternative 3, lynx denning habitat would decrease by approximately 193.5 acres resulting in a decrease of 7.4 percent in the amount of denning habitat available in the LAU.

Under Alternative 4, lynx denning habitat would decrease by approximately 95.2 acres resulting in a decrease of 3.6 percent in the amount of denning habitat available in the LAU.

Foraging Habitat

Cumulative effects to foraging habitat are primarily associated with the ski area and housing development in this LAU. These types of activities result in a permanent loss of lynx foraging habitat, since lands cleared for development are typically not allowed to regenerate into a condition suitable for snowshoe hare habitat. Past timber harvest is primarily responsible for producing lynx foraging habitat. Since foraging habitat is generally comprised of young and/or small diameter trees that have no commercial timber value, it is not likely that there would be additional impacts to existing lynx foraging habitat due to commercial timber harvest. Timber management strategies often involve pre-commercial thinning of young coniferous stands to improve the growth and production of wood for future harvest. There are no corporate timber lands remaining in the SB LAU and individual private landowners are not likely to incur the investment required for pre-commercial thinning.

With all of the action alternatives, only krummholtz (high elevation, wind stunted) foraging habitat would be affected. Small amounts of this habitat would be removed or otherwise impacted by these alternatives, in all cases resulting in less than one percent change for available foraging habitat. Further, under all alternatives, some currently unsuitable habitat created by recent timber harvest outside the ski area boundary would be expected to naturally regenerate to a condition where it produces high quality lynx foraging habitat within 15 to 20 years post-harvest.

The Bostwick fire of 1991 burned on the west side of the Bridger Ridge, adjacent to the SB LAU. Intense fire suppression efforts kept this fire from jumping the ridge and burning into the SB LAU, and thus precluded the potential development of additional lynx foraging habitat. The land exchange in progress for the Brackett Creek area would result in the Forest Service acquiring a slight net gain in lynx habitat, including some small recent harvest areas that should produce good foraging habitat in the next 10 to 15 years. Most of the lynx habitat traded into private ownership with this exchange is currently in a condition suitable for lynx, but not providing good denning or foraging habitat.

Currently, there are 2,241 acres of lynx foraging habitat available within the LAU. Under Alternative 1, there would be no additional cumulative effects to lynx foraging habitat as there would be no new development at Bridger Bowl. Lynx foraging habitat available within the LAU would remain at 2,241 acres.

Under Alternative 2, lynx foraging habitat would decrease by approximately 30.5 acres resulting in a decrease of 1.4 percent in the amount of foraging habitat available in the LAU.

Under Alternative 3, lynx foraging habitat would decrease by approximately 27.6 acres resulting in a decrease of 1.2 percent in the amount of foraging habitat available in the LAU.

Under Alternative 4, lynx foraging habitat would decrease by approximately 2.9 acres resulting in a decrease of 0.1 percent in the amount of foraging habitat available in the LAU.

Connectivity

Cumulative effects to habitat connectivity include past timber management activities, plus ski area and housing development on federal and private lands, which all have contributed to the existing degree of forest fragmentation in this LAU. The location of the Bridger Bowl in the middle of the LAU (see Figure 3-5), with many previously forested areas cleared for skiing facilities, has resulted in a continuous break in lynx habitat connectivity from the lower slopes to the ridge top in this landscape. Much of the recently (within the past 20 years) harvested forest habitat on federal land outside the ski area is starting to regenerate and should eventually progress to reconnect lynx habitat in the LAU. Timber harvest on private lands has mainly involved selective cutting in which some mature trees are left standing. These selective cuts continue to provide habitat connectivity for lynx but do not afford good denning or foraging habitat. Additional cumulative impacts could occur through potential future development of additional ski lifts, runs, roads and facilities on private lands in the base area. Most of this development would likely take place in lynx habitat that is currently suitable for travel or resting, but does not presently provide high quality denning or foraging habitat. There is potential for timber management and housing development on private land to further degrade landscape connectivity for lynx in this LAU.

When planning new or expanding recreational developments, the LCS requires that connectivity within linkage areas is maintained (McAllister 2002). Linkage areas are defined as habitat that provides landscape connectivity between blocks of lynx habitat. Linkage areas occur both within and between geographic areas where blocks of lynx habitat are separated by intervening areas of non-lynx habitat such as basins, valleys, agricultural lands or where lynx habitat naturally narrows between blocks. Connectivity provided by linkage areas can be degraded or severed by human infrastructure such as high-use highways, subdivisions, or other developments (McAllister 2002).

The linkage area concept is intended to identify areas important for lynx to move within or between blocks of habitat, and to maintain the integrity of such connecting areas so that no permanent barriers to lynx movement result from federally authorized actions. Since the Bridger Range is an isolated block of lynx habitat, linkage areas are important for maintaining the connectivity of this area with other blocks of habitat. Potential linkage areas for lynx have been identified to maintain connective habitat between the Bridger Range and surrounding blocks of lynx habitat including the Gallatin and Madison Ranges to the south, the Crazy Mountains to the east, and the Big Belt Mountains to the north.

Cumulative effects to linkage areas primarily result from residential development in the valley lands surrounding the Bridger Range. Resort development on private land within and adjacent to Bridger Bowl could encourage additional development on other private land in the area. This type of high-density development on private land has the potential

to degrade or fragment habitat connectivity in linkage areas. The Forest Service is in the process of completing a land exchange with private landowners in the Brackett Creek area of the LAU. This project involves transfer of properties including lynx habitat as well as adjacent linkage area. The Forest Service stands to gain a slight net increase in lynx habitat within the LAU, and would receive about an equal exchange of connecting habitat in the linkage area along Highway 86. The potential for this land exchange to contribute cumulative effects to linkage areas comes from the consolidation of private lands resulting from the exchange. Unifying the private property and removing the inclusion of public land improves the potential for development. The current landowner involved in the exchanged has expressed no interest in developing the affected land beyond the level necessary to accommodate immediate family. Additional cumulative effects may be incurred through development of other private lands in the linkage areas.

Interstate 90 runs past the SB LAU on the south end. This four-lane highway, a parallel railway and frontage road, have been identified as an impediment to wildlife movement (Craighead et al. 2002:2). I-90 bisects an area currently identified as linkage habitat for lynx. State route 86 (Bridger Canyon Road), which also affects linkage habitat, runs up through the LAU and provides access to the Bridger Bowl. Wildlife mortalities (though no lynx to date) do result from collisions with vehicles on Bridger Canyon Road; however, this highway does not currently pose a serious impediment to wildlife movement.

Alternative 1 would have no effect on linkage areas; therefore, there would be no cumulative effects associated.

Alternative 2 would impact lynx habitat and connectivity within the SB LAU as described above, but would have no direct effect on the non-lynx habitat identified as potential linkage areas surrounding the Bridger Mountain Range.

Alternative 3 would again have no direct effects on non-lynx habitat in linkage areas, but would have the same indirect and cumulative effects as described for Alternative 2.

Like the other two action alternatives, Alternative 4 would have no direct effects on linkage habitat.

Bald eagle (Haliaeetus leucocephalus)

Major activities that take place in the winter in the Bridger Range include motorized and non-motorized recreation in the form of snowmobiling and skiing/snowshoeing respectively, housing development and associated road building, and possibly winter timber harvest and associated road building. The most notable contribution to cumulative effects to bald eagles would be in the form of increased traffic and thus potential for road kills. Expanding urbanization of the Bridger Canyon area, increased winter recreation (snowmobiling and back-country skiing/snowshoeing), and increased skier capacity associated with the proposed expansion of Bridger Bowl would contribute to more traffic on Highway 89, which could result in greater numbers of road-killed wild and domestic animals. Bald eagles commonly feed on carrion from road-killed animals, which could

increase the potential for bald eagle collisions with vehicles. Bald eagle presence in the Bridger Range is typically limited to pass-through migrants due to the lack of available nesting and large bodies of water for foraging; although they will feed on carrion when it is available. The Proposed Action is not expected to result in significant cumulative effects to bald eagles.

Proposed Species

Gray wolf (Canis lupus)

The overall effect of the Bridger Bowl expansion on gray wolf populations would be minimal. Wolves use a variety of habitat types and appear to select habitat based upon prey availability. Big game populations in the GNF are considered stable and provide the primary source of prey for gray wolves. The Proposed Action would likely increase the amount of deer and elk foraging habitat within the Study Area resulting in a potential increase in use of the area by big game. However, ski area activities would be restricted to the winter months so big game summer range would not be adversely impacted by the Proposed Action (Pac, Pers. Comm., 1996). For these reasons, the Proposed Action is not expected to result in significant cumulative effects to gray wolves.

Forest Service Sensitive Wildlife Species

Peregrine falcon (Falco peregrinus)

Cumulative impacts to peregrine falcons from activities within the Bridger Range would be minimal. This determination is based on the limited presence of peregrines in the area. Recent efforts to restore peregrine falcon populations in the United States have met with great success and although it is expected that peregrine populations will continue to expand, the Bridger Range will not likely be selected for nesting and/or foraging habitat by peregrines as readily as other available habitat on the GNF due to the lack of major water sources (e.g., large rivers or lakes).

Flammulated owl (Otus flammeolus)

Flammulated owls are known to occur on the west side of the Bridger Range, where dry, open Douglas fir forests are more prevalent, approximately 12 miles from the Study Area. Timber harvests in the Bridger Range would reduce the available habitat for flammulated owls. Housing developments could permanently reduce nesting and/or foraging habitat for this species.

Black-backed woodpecker (Picoides arcticus)

Timber harvest, housing development, and road construction would impact potential nesting and foraging habitat for black-backed woodpecker. The degree of urbanization of the Bridger Range makes this area a high priority for fire suppression efforts. However, prescribed fire may be used in the Bridger Mountains to reduce fuel loading in urban interface areas, improve range conditions for livestock and wildlife, and to reintroduce fire into the ecosystem. These prescribed burns would create additional suitable habitat

for black-backed woodpeckers. With little suitable habitat currently available in the Bridger Range, and limited potential for habitat improvement with prescribed fire overall, the cumulative effects will have no impact on black-backed woodpeckers.

Wolverine (Gulo gulo)

For analysis purposes, an area roughly the size of the average home range for a female with young was delineated around the Study Area (see Figure 3-6). The Wolverine Analysis Area for this project includes timber compartments 504 and 515 plus sub compartments 503 - 04, 05, 06 and 07. This area was chosen because it is of sufficient size (34,418 acres) to contain the average home range of a female wolverine with young and contains all activities associated with the Proposed Action. The Wolverine Analysis Area spans both sides of the Bridger Range, with about half the acreage located on the east side where better denning habitat occurs, and the other half on the west side, where big game winter range could provide winter/denning season food sources in the form of ungulate carcasses. Approximately 8 percent (2,588 acres) of the analysis area contains suitable denning habitat for wolverines.

Cumulative effects to wolverines are primarily a result of habitat alterations, access route densities, and human-caused mortality. Within the ski area boundary, habitat has been altered through the removal of forest cover to create openings for ski runs, roads, etc; thinning of mature forest to open up areas for glade skiing; and removal of brush, snags, logs and lower branches to provide for skier safety. Elsewhere in the Wolverine Analysis Area, habitat alterations have occurred as a result of timber harvest, forest thinning, and wildfire. Removal of forest cover, thinning forested areas, and reduction of brush, woody debris and lower branches reduces available security cover for wolverines. Hiding cover protects wolverines, particularly the young, from other predators, and also provides habitat for various prey species.

Road and trail densities affect wolverines indirectly by facilitating human access, which can then have disturbance and/or displacement effects, or result in direct mortality of wolverines. Human presence can affect wolverine behavior patterns, and can potentially influence prey distribution. The primary cause of human-related wolverine mortality is trapping (Banci, 1994), which is directly affected by access into wolverine habitat. Effects to wolverines from human land uses and associated access are expected to be similar to effects of such activities on grizzly bears (Banci, 1994). The Grizzly Bear Management Plan for Southwestern Montana recommends managing open road densities at 1 mile per square mile or less in grizzly bear habitat (IGBC, 2003). Open road densities are currently below this level at 0.96 miles per square mile within the Wolverine Analysis Area, but would vary by alternative upon implementation as discussed in Chapter 4. A potential future action that could have cumulative effects to wolverines involves the acquisition of public access and potential trail development just south of Bridger Bowl. This possible change is identified in the Gallatin National Forest Travel Planning Benchmark (2002) and could facilitate substantial increases in human activity in the area south of Bridger Bowl. This area is currently land-locked by private land, and consequently receives little human use.

Wolverines potentially use the Bridger Range as a travel/dispersal corridor, as evidenced by genetic similarities between the Gallatin subpopulation of wolverines (which includes animals in the Bridger Range) with the Rocky Mountain Front subpopulation (Cigelski, 2002). High levels of forest fragmentation could compromise the integrity of the travel corridor currently provided on the east side of the Bridger Range. Forested habitat is still largely intact on the west side of the range and could continue to provide a relatively secure travel route.

Alternative 1 involves continuing permitted actions within the existing ski area boundary, with no new development and no expansion on national forest lands. Therefore, there would be no additional degradation of wolverine habitat within the Wolverine Analysis Area by ski area activities.

Cumulative effects to wolverines under Alternative 2 would include fragmentation of a portion of a large block of mature forest in the north expansion area. This fragmentation would further degrade habitat in the Wolverine Analysis Area that contains some of the most fragmented forested habitat on the Gallatin Forest (see Biodiversity discussion in section 3.4). Ski area features are a permanent encumbrance on the landscape, thus perpetuating forest fragmentation effects for many generations of wolverines. Under the Proposed Action approximately 276 acres of wolverine denning habitat would be impacted, resulting in a 10.6 percent decrease in the amount of available denning habitat within the Wolverine Analysis Area.

Cumulative effects under Alternative 3 would be similar to those described for Alternative 2, and would be primarily associated with continued habitat alteration and disturbance in high quality wolverine denning habitat and additional forest fragmentation. Under Alternative 3, approximately 202 acres of wolverine denning habitat would be impacted, resulting in a 7.8 percent decrease in the amount of available denning habitat within the Wolverine Analysis Area.

Cumulative effects under Alternative 4 would be similar to those described for Alternative 1, since this alternative does not involve the degree of forest fragmentation that would occur under alternatives 2 and 3. Under Alternative 4, approximately 74 acres of wolverine denning habitat would be impacted, resulting in a 2.8 percent decrease in the amount of available denning habitat within the Wolverine Analysis Area.

Northern goshawk (Accipiter gentilis)

Cumulative effects to goshawks and their habitat in the Bridger Range would occur from timber harvest, prescribed burning, housing development and road construction. Removal of mature to old-growth forest through any of these practices would reduce overall potential goshawk nesting habitat in the Bridger Range. Removal of trees, snags, brush and/or down woody debris through such activities could also impact foraging habitat for goshawks. However, it should be noted that selective timber harvest and prescribed burning could also improve goshawk foraging habitat by increasing habitat for prey species such as rabbits and hares and by opening up the understory in forested areas, thereby improving conditions for hunting prey.

Western big-eared bat (Corynorhinus townsendi)

The greatest concern over impacts to western big-eared bats involves loss and/or disturbance of suitable roosting habitat (Tuttle, 1979; McCracken, 1988). Degradation of foraging habitat could also have negative effects on bat populations (Pierson, 1988). Due to the lack of suitable roosting habitat in the Study Area, and very minimal degree of disturbance to potential foraging habitat, there would be no impact to the western big-eared bat under alternatives 2-4. However, additional foraging habitat would be created through clearing of forest for ski trails.

Activities in the Bridger Range that could affect foraging habitat include timber harvest, housing development, road construction, grazing, and prescribed burning. Impacts from these types of activities would be associated with conversion of native vegetation to less suitable foraging habitat, e.g., road surface, housing and lawn development, and conversion of riparian and mesic habitats to more xeric (dry) types through impacts to wetlands. Prescribed burning and conservative amounts of timber harvest could improve foraging habitat by improving vegetative establishment and increasing structural diversity in a manner that will favor production of insect prey.

Northern leopard frog (Rana pipiens)

Past, current, and future projects listed earlier in this section could influence cumulative effects to the northern leopard frog. Projects such as livestock grazing in suitable habitat, agriculture and residential homes that use fertilizers and pesticides which degrade water quality, and stocking of predatory game fish at sites that currently lack them, are all considered to contribute to impacts to the northern leopard frog. In addition, developments that drain or alter breeding habitat permanently reduce the available habitat for this low mobility species.

Brackett Creek Watershed

Under Alternative 1 activities associated with the existing ski area operations would have no additional cumulative effects on northern leopard frogs. Under alternatives 2 and 3 there would be approximately 0.48 acres of potential wetland impacts from vegetation clearing. These impacts would be limited to hand clearing of vegetation and significant effects to the structure and function of the wetlands are not expected to occur. Under Alternative 4, there would be no impacts to wetlands. The elevation of impacted wetlands (over 6500 feet) indicates that northern leopard frogs are unlikely to be present (Montana Fish, Wildlife and Parks website, 2004). Implementation of mitigation measures VM-3, VM-4, and VM6 is designed to minimize impacts to wetlands and would reduce potential impacts to individuals which may occur in the Study Area. For these reasons the Bridger Bowl Expansion is not expected to contribute further cumulative effects to the habitat of the northern leopard frog.

Bridger Creek Watershed

No wetland impacts associated with the Bridger Bowl Expansion would occur in the Bridger Creek watershed. Under Alternative 1 activities associated with the existing ski

area operations would have no additional cumulative effects on northern leopard frogs. alternatives 2 and 4 propose a road in the southern expansion area which would cross a perennial stream. This stream provides potential breeding habitat for the northern leopard frog. Implementation of mitigation measure RP-1 is designed to minimize impacts to streams and would reduce potential impacts to individuals which may occur in the Study Area. In addition, this road would be closed during the off-season when northern leopard frogs are most likely to be active. Under Alternative 3, there would be no impacts to northern leopard frog breeding habitat within the Bridger Creek watershed.

Boreal toad (Bufo boreas boreas)

Past, current, and future projects listed earlier in this section could influence cumulative effects to the boreal toad. Projects such as livestock grazing in suitable habitat, agriculture and residential homes that use fertilizers and pesticides which degrade water quality, and stocking of predatory game fish at sites that currently lack them, are all considered to contribute to impacts to the boreal toad. In addition, developments that drain or alter breeding habitat permanently reduce the available habitat for this low mobility species.

Brackett Creek Watershed

Under Alternative 1 activities associated with the existing ski area operations would have no additional cumulative effects on boreal toads. Under alternatives 2 and 3 there would be approximately 0.48 acres of clearing impacts to potential wetland breeding sites within the northern expansion area. These impacts would be limited to hand clearing of vegetation and significant effects to the structure and function of the wetlands are not expected to occur. Implementation of mitigation measure W-5 in Table 2.6-1 would minimize construction related impacts to boreal toads that may be using the wetlands in the north expansion area for breeding by providing pre-construction surveys and implementing BMPs if needed. Under Alternative 4, there would be no impacts to boreal toad breeding habitat within the Brackett Creek watershed.

Bridger Creek Watershed

Under Alternative 1 activities associated with the existing ski area operations would have no additional cumulative effects on boreal toads. No impacts to wetlands are proposed under alternatives 2 and 4 in the Bridger Creek Watershed. However, alternatives 2 and 4 propose a road in the southern expansion area which would cross a perennial stream. This stream provides potential breeding habitat for boreal toad. Implementation of mitigation measure W-5 in Table 2.6-1 would minimize construction related impacts to boreal toads that may be using the stream in the south expansion area for breeding by providing pre-construction surveys and implementing BMPs if needed. In addition, this road would be closed during the off-season when boreal toads are most likely to be active. Under Alternative 3, there would be no impacts to boreal toad breeding habitat within the Bridger Creek watershed.

Management Indicator Species

Pine marten (Martes americana)

Cumulative effects to pine marten in the Bridger Range would be contributed to by activities such as housing development, road construction, timber harvest and prescribed burning. All of these activities could degrade pine marten habitat by removing important habitat components such as large trees and snags, and down woody debris. Urban development in the Bridger Range could have further detrimental cumulative effects to pine marten by producing attractants in the form of human food and/or garbage which could increase potential for conflicts resulting in direct moralities for pine marten. . The Bracket Creek Land Exchange would aid in the creation of a more contiguous landscape in which these large ungulates could migrate, forage, and find security.

Migratory birds

Cumulative effects to migratory birds would result from past, present and reasonably foreseeable future actions on federal, state and privately owned property, which have or would produce, further alteration of nesting habitat.

Past timber management, ski area development on private land, housing development and associated roading in the southeast Bridgers has produced some of the most highly fragmented forest habitat on the GNF. There is still a considerable proportion of private land in the Bridger Range on which some level of timber harvest can reasonably be expected to occur in the future. Currently, there are no timber harvests planned on federal lands in compartment 504 or 515 surrounding Bridger Bowl. Fragmentation effects associated with timber harvest for wood production are temporary. Although the effects may last for many generations of forest interior bird species, eventually, the forests are expected to grow back and provide nesting habitat. However, fragmentation effects associated with ski area and housing/commercial development produce a permanent encumbrance upon the landscape and the resultant loss of forest interior nesting habitat would be maintained in perpetuity.

Game birds and mammals

Cumulative effects to game birds and mammals would result from past, present and reasonably foreseeable future actions on federal, state and privately owned property, which have or would produce further alteration of foraging and cover habitat.

Past timber management, housing development and associated roading in the southeast Bridgers has produced some of the most highly fragmented forest habitat on the GNF. There is still a considerable proportion of private land in the Bridger Range on which some level of timber harvest can reasonably be expected to occur in the future. There is currently no timber harvest planned on federal lands in compartment 504 or 515 surrounding the SUP area. Fragmentation effects associated with timber harvest for wood production are temporary. In some cases, timber harvests can increase foraging habitat for many big game species, while at the same time reducing cover and security habitat. Although the effects of timber harvest may last for many generations of game

birds and mammals, eventually, the forests are expected to grow back and provide cover habitat. However, fragmentation effects associated with ski area and housing/commercial development produce a permanent encumbrance upon the landscape and the resultant loss of forest interior nesting habitat would be maintained in perpetuity.

Blue grouse (Dendragapus obscurus)

Blue grouse commonly winter within the ski area, where they feed on conifer needles, and are frequently encountered by skiers. This species is more common at higher altitudes although it does occasionally descend to lower altitudes in the spring. Housing developments would permanently remove foraging and security habitat for this species. Timber harvests within the Bridger Range would remove forests that provide security and foraging, however, blue grouse are also known to feed at forest edges and openings during the spring.

Ruffed grouse (Bonasa umbellus)

Ruffed grouse are closely associated with aspen stands and rely heavily on aspen buds as a winter food source. This species is found at lower altitudes than the blue grouse and utilize deciduous thickets and riparian areas for foraging and cover. Housing developments would permanently remove foraging and cover habitat for this species. Timber harvests within the Bridger Range would remove forest cover but would most likely be located at higher elevations outside of the range of this species. Lower elevation timber harvest could result in the creation of foraging habitat as shrubs flourish in the recently harvested areas. Therefore, there would be no additional cumulative effects.

Elk (Cervus elaphus), Mule deer (Odocoileus hemionus), Moose (Alces alces)

Elk and mule deer are commonly observed within the Study Area during the summer and fall seasons but do not remain in the area during the winter. Moose are known to be year round residents. Additional developments within the Bridger Range for housing and recreation could affect populations by reducing cover and foraging habitat. As with elk and moose, mule deer utilize forested areas as cover and security habitat and forage in open shrub and herbaceous habitat; these habitat components would be permanently removed as a result of housing developments. The Bracket Creek Land Exchange would aid in the creation of a more contiguous landscape in which these large ungulates could migrate, forage, and find security.

White-tailed deer (Odocoileus viginianus)

White-tailed deer generally frequent lower elevations and are not expected to occur regularly within the Study Area. No cumulative impacts to white-tailed deer are expected to occur under any of the action alternatives.

Mountain goat (Oreamus americanus)

Mountain goats have only been observed along the Bridger Ridge and are expected to be occasional residents to the Study Area. Cumulative impacts to mountain goat habitat are not expected to occur under any of the action alternatives.

Black bear (Ursus americanus)

Black bears are known to occur within the Study Area. Proposed timber harvests within the Bridger Range would contribute to fragmentation of the landscape. Since black bears are considered habitat generalists they would still be able to utilize the open areas created by logging, however, fragmentation could lead to reduction in security habitat and travel habitat, which is typically in forested areas. Additional housing developments could lead to increased human-bear interactions and such interactions could result in human and/or bear injury and mortality. The Brackett Creek Land Exchange would lead to increased habitat continuity which could provide travel and security habitat for black bears.

Mountain lion (Felis concolor)

Mountain lions most likely use the Study Area in association with the presence of ungulates; therefore effects to deer, elk, and moose would, to some degree, affect the distribution and presence of mountain lions within the Study Area. In addition, proposed timber harvests within the Bridger Range would contribute to fragmentation of the landscape, affecting travel and security habitat for mountain lions. As with black bear, additional housing developments could lead to increased human-mountain lion interactions and such interactions could result in human and/or mountain lion injury and mortality. The Brackett Creek Land Exchange would lead to increased habitat continuity which could provide travel and security habitat for mountain lions.

Other Species of Interest

Boreal owl (Aegolius funereus)

Cumulative effects to boreal owls in the Bridger Range would occur from loss of suitable habitat associated with the proposed expansion as well as past and future timber harvest, prescribed burns, future housing development including the Bridger Pines, and road construction, which will also contribute to the overall decline in boreal owl nesting habitat. Additional snow compaction beyond the existing Bridger Bowl boundaries may have the cumulative effect of further reducing prey availability for boreal owls in the Bridger Range. Motorized and non-motorized recreation has increased noticeably in the Bridger Mountains in the past decade. Snowmobiling is extremely popular and widespread in the Bridger Mountains, particularly on the east side where snow accumulation is greatest. Expansion of ski area into these areas would further reduce the availability of refuge areas for wildlife from motorized equipment.

4.16.6 FISHERIES

Aquatic environments in forested ecosystems are known to be heavily influenced by the physical and biological process within the watershed as a whole (Barndt, 2003). Cumulative effects are spatial and/or temporal environmental effects to fish habitat resulting from the additive, repeated, and synergistic effects of other actions. The scale of the cumulative effects analysis for fisheries is the SF Brackett Creek Watershed and the Upper Bridger Creek Watershed. For the purpose of this analysis, the Upper Bridger Creek Watershed includes Upper Bridger Creek, Maynard Creek, and Slushman Creek. Cumulative effects on fisheries include the existing or baseline conditions described in Section 3.6 – Fisheries, those impacts associated with the Bridger Bowl SDEIS described in Section 4.6 – Fisheries, and other past, present, and reasonably foreseeable projects identified in the introduction to this cumulative effects section. These other projects include projects not associated with the Bridger Bowl SDEIS and have already, currently are, or are going to occur on lands within the Brackett Creek and Upper Bridger Creek Watersheds.

South Fork Brackett Creek Watershed

Alternative 1

With implementation of Alternative 1, there would be no impacts to fisheries, so the only additional cumulative effects would include the past, present, and reasonably foreseeable projects not related to the Bridger Bowl SDEIS that would occur within the SF Brackett Creek Watershed and are described in the introduction to this section. Past timber harvest by Bohart Ranch is considered a cumulative effects project that was incorporated into the sediment yield analysis used to determine the impacts of the alternatives. The Brackett Creek Grazing Allotment in another past and ongoing cumulative effects project, but it would not affect the results of the R1R4 sediment model because the model inputs are based primarily on land disturbance activities such as timber harvest, earth moving, and road building. No known reasonably foreseeable projects have been identified within the SF Brackett Creek Watershed that would affect the inputs in the R1R4 sediment model. Therefore, the analysis of cumulative effects on fisheries in the SF Brackett Creek Watershed is adequately addressed by the sediment model, which addresses the action alternatives and other past projects at the watershed scale.

The SF Brackett Creek sediment delivery rate is currently estimated at 8.2 percent over natural conditions with the existing road network. According to the 1999 MOU discussed in Chapter 3, the GNF sediment guideline for accelerated sediment delivery is 30 percent over natural conditions on an annual basis for the SF Brackett Watershed. The modeled sediment delivery rate for existing conditions is 8.2 percent over natural conditions for SF Brackett Creek, which is well below this level and would therefore meet the land-use strategy for Yellowstone cutthroat trout.

No populations of westslope cutthroat trout or Artic grayling have been documented in the SF Brackett Creek Watershed and the historic ranges for these species do not include the SF Brackett Creek Watershed. Since there are no known populations of these species

present in the SF Brackett Creek Watershed, the identified past, present, and reasonable foreseeable projects would not result in cumulative impacts to these MIS and sensitive species.

Alternatives 2 and 3

The cumulative effects analysis for the Brackett Creek Watershed combines alternatives 2 and 3 because the potential sediment impacts to this watershed would be identical. The maximum sediment delivery due to construction activities proposed under alternatives 2 and 3 is estimated to increase delivery rates to 10.1 percent over natural conditions, which is a 1.8 percent increase over existing rates. The cumulative rate of sediment deposition in for the project implementation period is predicted to be approximately 1.3 percent with no routing being considered. In conclusion, this level of sediment delivery and deposition within SF Brackett Creek would have extremely limited, if any, negative effect on Yellowstone cutthroat trout habitat within the Brackett Creek Watershed. In addition, the modeled sediment delivery rate for alternatives 2 and 3 is 10.1 percent over natural conditions for SF Brackett Creek, which is well below 30 percent standard set in the 1999 MOU; as a result, it would meet the land-use strategy for Yellowstone cutthroat trout.

As stated above under Alternative 1, no ongoing or reasonably foreseeable cumulative effects projects would increase sediment delivery to the SF Brackett Creek Watershed. Based on the analysis of impacts from all known past, present, and reasonably foreseeable projects in the SF Brackett Creek Watershed, there would be no additional cumulative impacts to MIS and/or sensitive fisheries with implementation of alternatives 2 and 3.

No populations of westslope cutthroat trout or Artic grayling have been documented in the SF Brackett Creek Watershed and the historic ranges for these species do not include this watershed. Since there are no known populations of these species present in the SF Brackett Creek Watershed, alternatives 2 and 3 would not result in cumulative impacts to these species.

Alternative 4

There would be no sediment delivery impacts to the SF Brackett Creek Watershed as a result of project implementation under Alternative 4. Therefore, the only cumulative effects on MIS and/or sensitive fisheries under Alternative 4 include the past, present, and reasonably foreseeable projects not related to the Bridger Bowl SDEIS that would occur within the SF Brackett Creek Watershed. The cumulative effects of these projects are disclosed above in the analysis for Alternative 1.

Upper Bridger Creek Watershed

Alternative 1

With implementation of Alternative 1, there would be no impacts to fisheries, so the only cumulative effects would include the past, present, and reasonably foreseeable projects not related to the Bridger Bowl SDEIS that would occur within the Upper Bridger Creek Watershed and are described in the introduction to this section. All of the known cumulative effects projects that have occurred in the recent past were incorporated into the sediment yield analysis used to determine the impacts of the alternatives, including recently completed development in the Bridger Bowl base area, timber harvest by Bridger Bowl for trail development, past Bridger Pines development, and the Big Sky Lumber Harvest. The reasonably foreseeable projects identified within the Upper Bridger Creek Watershed are primarily small residential development projects in the Bridger Park subdivision and the remaining undeveloped home sites in the Bridger Pines subdivision. Future development of single family homes in these subdivisions would not likely result in measurable sediment yield impacts to the Upper Bridger Creek Watershed because of the small size, and staggered timeframe of the housing sites. In addition, these development projects will have to follow the provisions of the Montana Streamside Protection Act, included observation of the 50 foot-wide Stream Management Zones. Since the known reasonably foreseeable projects that have been identified within the Upper Bridger Creek Watershed are not likely to affect the R1R4 sediment model, the analysis of cumulative effects on fisheries in the Upper Bridger Creek Watershed is adequately addressed by the sediment model, which addresses the impacts of the action alternatives and other past projects at the watershed scale.

The three tributaries to the mainstem of Bridger Creek analyzed by the R1R4 sediment model do not have any documented fish presence and are all considered Class D streams by the GNF. According to GNF guidelines, to protect Class D streams, sediment increases should not exceed 100 percent above natural rates. According to estimates from the R1R4 model, the existing sediment yield to the three tributaries to the mainstem of Bridger Creek range from 27 to 77 percent above natural conditions. Therefore, the cumulative effects from all past Bridger Bowl and other projects within the Upper Bridger Creek Watershed have resulted in sediment yields that are within the GNF standard for Class D streams.

Suitable habitat for westslope cutthroat trout exists downstream of the Upper Bridger Creek Watershed. Since the sediment yield estimates are within the GNF standards, it is assumed that there are no current cumulative effects to this species. There are no current cumulative effects to Artic grayling because there is no suitable habitat in the three tributaries to Bridger Creek and no documented presence for this species in the entire Bridger Creek Watershed.

No populations of Yellowstone cutthroat trout have been documented in the Upper Bridger Creek Watershed and the historic range for this species does not include the Upper Bridger Creek Watershed. Since there are no known populations of this species

present in the Upper Bridger Creek Watershed, the identified past, present, and reasonable foreseeable projects would not result in cumulative impacts to this species.

Alternative 2

Under Alternative 2, there would be 57 acres of temporary soil impacts, seven acres of permanent soil impacts, and one new road stream crossing, which may be a potential source of sediments to streams within the Study Area. Induced sedimentation from the existing and proposed developments and disturbances in the Upper Bridger Creek Watershed was evaluated using the R1R4 model (Cline et al., 1981). The maximum sediment delivery due to construction activities proposed under Alternative 2 is estimated to increase delivery rates in the three tributaries to the mainstem of Bridger Creek by 1.5 to 3.5 tons per year, increasing rates over natural conditions to 28.4 to 83.9 percent. Increases in sediment yield as a result of activities proposed under Alternative 2 would not exceed the 100 percent above natural rates guidelines of the GNF. Therefore, this level of sediment delivery and deposition within Upper Bridger Creek Watershed would have extremely limited, if any, negative effect on westslope cutthroat trout habitat within the Upper Bridger Creek Watershed. Alternative 2 would not have any cumulative effects from known projects on Yellowstone cutthroat trout or Artic grayling because there is no suitable habitat in the three tributaries to Bridger Creek and no documented presence for these species in the entire Bridger Creek Watershed.

As stated above under Alternative 1, the known reasonably foreseeable cumulative effects projects in the Upper Bridger Creek Watershed would not likely to affect the R1R4 sediment model. Based on the analysis of impacts from all known past, present, and reasonably foreseeable projects in the Upper Bridger Creek Watershed, there would be no cumulative impacts to fisheries from implementation of Alternative 2 other than the impacts previously disclosed for Alternative 2.

Alternative 3

Cumulative impacts on fisheries in the Upper Bridger Creek Watershed from sediment yield from Alternative 3 would be less than Alternative 2 because there would be no development in the Slushman Drainage. Under Alternative 3, there would be no additional sediment impacts to Slushman Creek over existing conditions. Sediment impacts to Upper Bridger Creek and Maynard Creek would be the same under Alternative 3 as in Alternative 2. Since increases in sediment yield from Alternative 3 would not exceed GNF guidelines, there would be extremely limited, if any, negative effects on westslope cutthroat trout habitat within the Upper Bridger Creek Watershed. In addition, Alternative 3 would not have any cumulative effects from known projects on Yellowstone cutthroat trout or Artic grayling because there is no suitable habitat in the three tributaries to Bridger Creek and no documented presence for these species in the entire Bridger Creek Watershed.

As stated above under Alternative 1, the known reasonably foreseeable cumulative effects projects in the Upper Bridger Creek Watershed would not likely to affect the R1R4 sediment model. Based on the analysis of impacts from all known past, present,

and reasonably foreseeable projects in the Upper Bridger Creek Watershed, there would be no cumulative impacts to fisheries from implementation of Alternative 3 other than the impacts previously disclosed for Alternative 3.

Alternative 4

Under Alternative 4, the development activities proposed in the Bradley Meadows area would not occur. As a result of the reduction of road and trail building in Upper Bridger Creek and Maynard Creek, the estimated sediment yield to these streams would be less under Alternative 4 than under Alternative 2. Sediment yield impacts to Slushman Creek would be the same under Alternative 4 as Alternative 2 because the S-1 and P-2 lifts would be constructed. Since increases in sediment yield from Alternative 4 would not exceed GNF guidelines, there would be extremely limited, if any, negative effects on westslope cutthroat trout habitat within the Upper Bridger Creek Watershed. In addition, Alternative 4 would not have any cumulative effects from known projects on Yellowstone cutthroat trout or Artic grayling because there is no suitable habitat in the three tributaries to Bridger Creek and no documented presence for these species in the entire Bridger Creek Watershed.

As stated above under Alternative 1, the known reasonably foreseeable cumulative effects projects in the Upper Bridger Creek Watershed would not likely to affect the R1R4 sediment model. Based on the analysis of impacts from all known past, present, and reasonably foreseeable projects in the Upper Bridger Creek Watershed, there would be no cumulative impacts to fisheries from implementation of Alternative 4 other than the impacts previously disclosed for Alternative 4.

4.16.7 ROADLESS

Timber harvests, ski area development, and residential development on private lands have all affected the appearance and character of the roadless area adjacent to the Bridger Bowl SUP as a result of human presence and manipulation of the environment. The physical proximity to this development has decreased opportunities for feelings of remoteness and solitude within the IRA. Continued operations of the ski area and proposed project elements would continue to affect the wilderness quality of this area.

4.16.8 AIR QUALITY

The air quality analysis for Alternative 2 includes a cumulative effects evaluation of existing air quality in the Bridger Bowl area considering local sources (construction equipment, vehicles, road dust, residential wood burning, and smoke from logging slash disposal), motor vehicle emissions, and stationary sources within 60 miles. Air quality within the Bridger Range and Bridger Bowl is excellent with very limited local sources and consistently robust wind dispersion (Elliott et al., 1986). Increased development of the Bridger Bowl base area and surrounding private lands could pose additional air quality impacts as a result of construction and additional vehicular traffic; however, the majority of this development would likely serve to reduce traffic along BCR as it would

be designed to accommodate guests in closer proximity to the ski area, thereby decreasing the need to travel between the resort and Bozeman.

4.16.9 CULTURAL RESOURCES

No cultural resources were identified within the Study Area; therefore, no past or ongoing activities have been known to affect these resources. As a result, none of the reasonably foreseeable future actions identified for this proposal are anticipated to affect cultural resources.

4.16.10 RECREATION

An anticipated increase in skier visitation at Bridger Bowl as a result of this proposal combined with improvements at competing Montana ski areas would cumulatively stimulate skier visitation in the region. Approval of any of the action alternatives would likely encourage the development of lodging and other recreation amenities on private land in the immediate vicinity of Bridger Bowl. To a certain degree, the rate of this private development may also dictate the rate of full implementation of any action alternative. The cumulative effect of ski area and base area development may result in the overall growth of skier visitation in the state of Montana. This would represent the continuation of a long-term trend, which is demonstrated by Montana's growing importance in the alpine skiing marketplace.

The demand for hiking, horseback riding, mountain biking, and other summer recreation opportunities within the SUP would also be expected to increase as a result of local and regional population growth and off-site developments that attract new visitors to Bridger Bowl and the Bozeman area. The proposed travel management plan, which is currently being prepared by the GNF, may change recreation use patterns in the surrounding area. If approved and implemented, the portion addressing SF Brackett Creek would change access routes. Over the long term, other off-site public and private recreation developments could serve to disperse recreational use patterns on the GNF.

4.16.11 VISUAL RESOURCES

Past actions that have affected the visual quality of the area as viewed from Bridger Canyon Road (BCR) include timber harvests, ski area development, and residential development adjacent to Bridger Bowl. The existing ski area is a generally accepted characteristic of this area. Ongoing residential development, ski area operations, and agriculture on private and public land in the vicinity would likely result in incremental impacts to visual quality along BCR over the long term. The proposed expansion of the Bridger Bowl SUP into Bradley Meadows would increase the number and size of the openings in an area that is visually sensitive to passersby on BCR. However, under a Forest Plan amendment, the land designation would change from MA 12 to MA 2. Direction for MA 2 is to meet a VQO of *Partial Retention*, and each of the action alternatives would be consistent with this direction.

4.16.12 SOCIO-ECONOMIC RESOURCES

As cited by civic and business groups in the community in their promotional literature, Bridger Bowl contributes to the overall quality of life in the Bozeman and Gallatin Valley areas. It is a recreational outlet that serves as a complement to the business, cultural, and educational opportunities in the area. Patronage by local residents and its ranking as one of the largest employers in Gallatin County indicate its importance to the community.

The proposed improvements would be expected to improve the ski area's viability and potentially additional private commercial activity and employment opportunities in the tourism industry. Improvements at the ski area could generate conversion of surrounding rural private lands to commercial or residential use, impacting the corresponding property tax bases. Additional taxable business property, such as chairlifts at the resort, would result in additional fees being paid to both the state and the county in the form of taxes.

Full build-out of any of the action alternatives would depend largely upon increased residential and commercial development of private lands near the base of the ski area. Projected population increases and demand for residential and vacation housing on lands at and near the ski area are expected to drive the need for expansion of the ski area facilities, rather than ski area expansion creating the demand for housing. Development in Bridger Canyon would continue to be governed by the Bridger Canyon Zoning Ordinance, which strictly limits the amount of development on the private lands in the immediate vicinity of Bridger Bowl.

4.16.13 TRANSPORTATION

Past activities that have affected traffic along BCR include ski area development and dispersed recreation along the canyon. The proposed project elements are anticipated to result in an increase in skier visitation and, as a result, an increase in traffic along BCR. Further development of the Bridger Bowl base area and surrounding private lands could pose additional traffic congestion. However, there is limited potential for development as a result of zoning restrictions. The majority of development that could occur would likely serve to reduce traffic along BCR and the Bridger Bowl access road as well as the demand for parking as it would be designed to accommodate guests in closer proximity to the ski area, thereby decreasing the need to travel between the resort and Bozeman.

4.16.14 INFRASTRUCTURE AND UTILITIES

The majority of the infrastructure and utilities at the ski area are specific to Bridger Bowl, including domestic water from wells, on-site wastewater treatment, fuel storage, and mountain access roads. Since the MDP has a lifetime of 40 years, no other reasonably foreseeable future actions are anticipated at the ski area that would affect these resources. Electric power is relative to all of Bridger Canyon. Power demand is not expected to change appreciably in the canyon due to the limited development potential as governed by zoning restrictions. There would likely only be small increases in power demand as a result of individual residences being built along the canyon.

4.16.15 NOISE

Cumulative effects for noise as a result of the proposal include an evaluation of existing noise in the Bridger Bowl area in conjunction with local noise sources nearby such as residential developments in the base area and BCR. Noise within Bridger Canyon is not expected to change appreciably over time because of the limited development potential of the surrounding area due to zoning restrictions. Since there are no known State of Montana or Gallatin County noise ordinances, Bridger Bowl would not violate any codes with implementation of any of the action alternatives.

4.17 RELATIONSHIP BETWEEN SHORT-TERM USE AND LONG-TERM PRODUCTIVITY

In this section, short-term effects (beneficial and adverse) of the alternatives are discussed in terms of their implications for the long-term stability and productivity of the environment at Bridger Bow.

Bridger Bowl has been committed to long-term management since the SUP was issued in 1956. This use accommodates a high level of recreation visits on a relatively small portion of the GNF. In a statement related to the operation of ski areas, Jack Ward Thomas, Chief of the U.S. Forest Service, noted that "[t]here is probably nowhere on National Forest land that we provide so much use on such a small area with such low impact" (Seattle Times 8/7/94, p. B4). The alternatives continue this long-term commitment of the local environment to a relatively high-density recreational use. Continued development creates an opportunity for a considerably greater number of people to utilize the area.

There would be a potential for direct, indirect, and cumulative effects on soil from vegetation clearing, parking lot construction, and other earthwork. Losses of long-term productivity would be expected to be palliated by proposed mitigation measures, particularly those calling for the minimization of vegetation removal, protection of streams, and revegetation of disturbed areas. Effects would vary by alternative with the amount of management activities.

In the long-term, emissions into the atmosphere would be augmented by increased vehicular use, as well as construction and operation activities. Soil productivity would be lost where facilities are developed. The loss of wildlife habitat would continue as long as Bridger Bowl facilities are in place. Hydrologic effects would generally be short-term, related to the period between construction and completion of revegetation. The removal of vegetation, particularly trees and shrubs, would change the composition of vegetation communities. The placement of additional ski lifts and trails, parking lots and other facilities would change the area's visual character.

The noise levels within and adjacent to the permit area would be raised. The amount of land dedicated to alpine skiing would be increased with the ski terrain and lifts proposed. The population, both seasonal and permanent, within the Bridger Bowl community would increase. Additional commercial and retail development would serve the increase in visitors. Changes to the character of the local community would occur. A broader tax base, resulting from expansion of Bridger Bowl and the indirect income provided by tourists, would be partially offset by increased demand for services. In the long-term, permit fees and taxes paid to the federal government and to Gallatin County would be expected to cover most additional costs. Highway maintenance and improvement costs would increase. Highway improvements and/or traffic mitigation would be necessary to accommodate the increased traffic congestion at peak times. The consumption of electrical power and fuels would increase. Additional water consumption would be necessary to meet development demands for both domestic and snowmaking purposes.

4.18 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Irreversible commitment of resources refers to non-renewable resources, such as cultural resources, or to those factors which are renewable only over long time spans, such as soil productivity. Irretrievable commitment applies to losses of production, harvest, or use of renewable natural resources. For example, the timber production capability of the area is irretrievably lost while the area is used as a winter recreation site. The production lost is irretrievable, but the action is not irreversible.

Ski resort development would represent an essentially permanent commitment of the area to a relatively high intensity recreational use. Additional development would not be a completely irreversible or irretrievable commitment of resources, although from a practical standpoint, it can be considered as such. Should the time come that development of Bridger Bowl within the permit area would no longer be desired or be viable and is amortized, the various facilities could be dismantled and removed, and the area revegetated or allowed to return to a natural state, although resource values could never be returned to their pre-development conditions.

Irreversible commitments would include construction of the new parking areas (which would be built on private lands) because of the earthwork required and the chemical action of petroleum-based surfacing, if paved. Other aspects of development, including lifts, utilities and buildings can be reversed and natural resources restored over time.

Loss of soil productivity would be irreversible at the sites of development. Compaction along trails and other places frequented by people could cause irretrievable impacts to the ability of these areas to support vegetation. Vegetation removed for facility development would be an irretrievable impact for at least the life of the facility. In highly developed areas, reclamation can be slow and costly. Timber harvest in the expansion area would be replaceable only in the very long term. If revegetation is not successful after disturbance for facility development, erosion could become a continuing problem, accompanied by concomitant loss of fertility and further reduction in revegetation potential.

Some loss of wildlife habitat would also be irretrievable for the life of Bridger Bowl. Increased human disturbance could cause some species to permanently avoid the area, thus indirectly impacting the carrying capacity of other areas on the mountain. The loss of some species using the area could be irreversible until such time as habitat is restored.

The visual resource would be irretrievably altered by the addition of lifts, ski trails and buildings for the life of these facilities.

Continued operation of Bridger Bowl as well as increased visitor use of the area represents increased potential for disturbance to historic and/or prehistoric resources in the project area.

4.19 SPECIFICALLY REQUIRED DISCLOSURES

EFFECTS OF ALTERNATIVES ON THREATENED AND ENDANGERED SPECIES AND/OR CRITICAL HABITAT

There would be no effect to gray wolf, bald eagle, and grizzly bear as a result of this proposal. Alternatives 2 and 3 would result in a determination of likely to adversely affect Canada lynx habitat, and Alternative 4 may affect but is not likely to adversely affect Canada lynx.

EFFECTS OF ALTERNATIVES ON PRIME FARM LAND, RANGELAND, AND FOREST LAND

All alternatives are in keeping with the intent of Secretary of Agriculture Memorandum 1827 for prime land. The project area does not contain any prime farmlands or rangelands. "Prime" forestland does not apply to lands within the National Forest system. In all alternatives, National Forest System Lands (NFSL) would be managed with sensitivity to the effects on adjacent lands.

ENERGY REQUIREMENTS OF ALTERNATIVES

There are no unusual energy requirements for implementing any of the alternatives.

EFFECTS OF ALTERNATIVES ON CIVIL RIGHTS AND EQUAL OPPORTUNITY (E.O. 12898)

The alternatives are not expected to affect civil rights to any degree, nor would the design, construction, or operation of the resort involve discrimination against any minority group or women. None of the alternatives would have this disproportionate adverse health or environmental impacts to minority, groups, women, or low-income populations. All alternatives comply with Title VI of the Civil Rights Act and E.O. 12898.

Expansion of Bridger Bowl, if approved, would operate under the direct permitting authority of the USDA Forest Service, GNF. The United States Department of Agriculture (USDA) prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political beliefs and marital or familial status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (braille, large print, audiotape, etc.) should contact the USDA Office of Communications at (202) 720-5881 (voice) or (202) 720-7808 (TDD). To file a complaint, write the Secretary of Agriculture, U.S. Department of Agriculture, Washington, D.C. 20250, or call (202) 720-7327 (voice) or (202) 720-1127 (TDD). USDA is an equal employment opportunity employer.

EFFECTS ON WETLANDS AND FLOODPLAINS

There would be no significant effects on wetlands resulting from any of the alternatives.

COMPLIANCE WITH SECTION 504 OF THE VOCATION REHABILITATION ACT AND THE AMERICANS WITH DISABILITIES ACT (ADA)

The permittee would be required to comply with all applicable provisions of Section 504 and the ADA. Compliance would be monitored through review of all construction plans and annual Operating Plans. Any new special use permit authorized would also include Section 504 and ADA compliance and monitoring provisions.